Issues of the relationship between humanization, humanitarization and mathematical modeling in engineering education

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Abstract. The article is devoted to the issues of humanization and humanitarization of education in a technical university. The importance of humanization of disciplines for the training of an engineer in demand by modern society is emphasized. The main types of humanitarization of mathematical education are considered. The components of the model of information processing by the human brain are presented. The relationship between the use of these models and the increase in students' motivation to learn is established. The mechanisms of translating the received information into knowledge by humanization are given. The paper presents examples of the application of these approaches. Fuzzy logic, and as its constituent fuzzy relations, which are guided by both teachers and students, only partly includes clear logical structures. Such inclusion manifests itself in different situations in different subjects with different degrees of belonging. Therefore, when studying technical or other exact disciplines, with the effective use by the teacher of the degree of such inclusion, students will have a special features to show learning results that exceed their own capabilities. The paper provides a comprehensive analysis of the process that contributes to the development and improvement of the personal parameters of a future engineering specialist.

1 Introduction

The expansion of the information flow of knowledge of a future specialist is the key to improving and improving his professional competence and further professional growth. The requirements for the level of knowledge, skills and abilities of future specialists are contained in the state educational standards for all specialties and areas of training. I. P. Pavlov wrote that "Life is only red and strong for those who strive for a goal all their life, or move from one goal to another with the same fervor. All life, all improvements, all its culture is made by a reflex of the goal, or is made only by people striving for one or another goal they have set for themselves in life" [1-4]. The system of higher education fully corresponds to the culture of our society, lifestyle, and spiritual values. It is able to develop actively, dragging the whole society with it. An important issue of the modern higher technical school is the

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humanization of engineering education. Kravets in his work on this problem notes that the humanization of education means the creation of an educational social system that meets the values and ideals of education [5-9]. Under the humanization of technical education, it is customary to understand the attitude to the personality and individuality of the student, the creation of accessible conditions for the realization of his abilities and opportunities. Without the psychological culture of teachers and students, it is impossible to organize creative cooperation within the team of students, regulate behavior and communication. A multinational, diverse audience with its own standards of culture deserves special attention. The interest in this problem develops and develops in the course of a dialogue of various personal meanings and values. A certain lack of culture in such a team can mean a lack of humanitarian content and ways of its deployment. Overcoming the deficit depends on the support and understanding of its direct participants. If a teacher of a technical university reveals the content of education through personal perception, experience, he can thereby model a certain attitude to the material of students. And such an approach requires tact, taking into account the composition of the audience, its level of development, and the general psychological mood. The humanization of education, its orientation to the individual and its development are recognized as the most relevant trends in modern society. It is necessary to reorient the learning goals from informational to developmental, to bring the content from the knowledge-alienated level to the personal-value level, it is necessary to rebuild the forms of education from authoritarian-unified to democratic-variable [10-15].

2 Materials and methods

The main principle of humanization of engineering education is the attitude to the student's personality, individuality, as well as providing conditions for the full manifestation of his capabilities and abilities. This trend can be implemented in any educational institution of an engineering profile through certain interaction technologies. One of the main conditions that ensure the effectiveness and success of the educational activities of students of a technical university is the organization of the educational process, taking into account the peculiarities of the training areas. The humanization of higher engineering education involves improving its organization: individual training, independent work, concretization of the goals and objectives of training. The professionalism of an engineer is manifested not only in individual creative and intellectual efforts, but also in the ability to work in a team, in the ability to maintain and establish interpersonal relationships, in the ability to find compromises when making priority engineering decisions. All forms of collective activity give a positive effect and increase motivation for educational and cognitive activities. The above is a problem of humanization of engineering education, associated with the need to counteract unnecessary individualism. Individual work involves active independent work of students to perform complex tasks that correspond to their professional orientation, as well as contribute to the development of their technical thinking and the formation of professional qualities of an engineer. Ya. A. Komensky wrote that: "we must study for life, and active, ready-made, educated specialists should come out of it, who can be entrusted with any business over time." To achieve the main goals of forming the personality of a highly qualified specialist, it is undoubtedly necessary to organize training at a good level, which in the future will ensure the transformation of one type of activity into another. In the rapidly changing conditions of life, the requirements for training students of a technical university are also changing rapidly. In this particular case, the issue of humanizing engineering education also becomes important. Regardless of the form in which the teacher will embody his forms of presentation of educational material, everything should reflect the modern qualitative level of scientific and pedagogical knowledge, as well as be based on the principles of professional training. In professional training, much attention is paid to the principle of humanization. In pedagogical...
practice, the principle of humanization puts forward a number of requirements, including the development of students' will, the desire for improvement, tolerance, respect for others. The main pedagogical prerequisite for the training of engineering specialists is the establishment of an optimal ratio of theoretical and practical in training, the development of creative thinking, research knowledge, skills and abilities. The experience of teaching students in universities shows that it is possible to solve quite effectively a number of tasks that are difficult to achieve in traditional education. And this is possible if students form not only cognitive, but also professional motives and interests, cultivate a systematic thinking of a specialist, including a holistic understanding of not only nature and society, but also themselves, their place in the world. Taking into account the current state of the dynamics of the development of society, to give a holistic view of professional activity and its large fragments, to teach mental and practical work, to foster a responsible attitude to social values.

The period of education at the university is a time of professional self-development and self-determination of the future specialist of the engineering direction, integration of his qualities, understanding of his own abilities. General humanitarian and general engineering training of engineering students should be permeated with their professional education, which means the system of professional orientation of students at the university level, the development of a stable interest in the future specialty, the formation of professional thinking and professional ethics. Humanities education plays the greatest role in the education of students, deeper and more thoroughly than other branches of higher education, forms the scientific worldview, value orientations and life orientations of students. In order to accelerate the process of humanization and humanitarization of engineering education that meets the requirements of modern society, it is necessary to find operational forms, methods of teaching theory and the contours of the formulated concept.

Let's consider the mathematical basis of the process of humanization and humanitarization of education.

As you know, the main mathematical actions are determined by algorithms of clear logic. A person is guided in his actions by a set of fuzzy and genetic logic. As a result, a multifaceted field of knowledge and opportunities is formed. These fields have some properties of mathematical fields: commutativity and multiplicativity. The information obtained is a multidimensional, multi-level matrix. Processing a set of data, the brain, depending on the situation and context, can perform various matrix multiplications, which leads a person to a certain choice in a particular situation.

Let's consider some possible multiplications:

1) The maximin product of fuzzy relations $\mathcal{R}_1$ and $\mathcal{R}_2$.

We define it on the set $U$, denote it as $\mathcal{R}_1 \circ \mathcal{R}_2$ and we will set the membership function defined by the formula:

$$M_{\mathcal{R}_1 \circ \mathcal{R}_2}(U_1; U_2) = \sup \left\{ \min \left( \mathcal{M}_{\mathcal{R}_1}(z; U_1): \mathcal{M}_{\mathcal{R}_2}(z; U_2) \right) \right\},$$

where $\mathcal{M}_{\mathcal{R}_i}$ – the membership function of fuzzy relations $\mathcal{R}_i$;

For example,

$$\mathcal{R}_1 = \begin{pmatrix} 0.4 & 1 & 0 \\ 0.7 & 0 & 0.6 \\ 0.9 & 0 & 0.05 \end{pmatrix}, \quad \mathcal{R}_2 = \begin{pmatrix} 0 & 0.1 & 0 \\ 0.9 & 0.3 & 0.2 \\ 1 & 1 & 0 \end{pmatrix},$$

$$\mathcal{R}_1 \circ \mathcal{R}_2 = \begin{pmatrix} \sup(0; 0.9; 0) & \sup(0.1; 0; 0.3; 0) & \sup(0; 0.2; 0) \\ \sup(0; 0; 0.6) & \sup(0.1; 0; 0.6) & \sup(0; 0; 0) \\ \sup(0; 0; 0.05) & \sup(0.1; 0; 0.05) & \sup(0; 0; 0) \end{pmatrix} = \begin{pmatrix} 0.9 & 0.3 & 0.2 \\ 0.6 & 0.6 & 0 \\ 0.05 & 0.1 & 0 \end{pmatrix}.$$
2) The minimax product of fuzzy relations $\mathcal{R}_1$ and $\mathcal{R}_2$.

We define it on the set $U$, denote it as $\mathcal{R}_1 \circ \mathcal{R}_2$ and we will set the membership function defined by the formula:

$$M_{\mathcal{R}_1 \circ \mathcal{R}_2}(U_1; U_2) = \inf \{ \max \{ M_{\mathcal{R}_1}(U_1; z); M_{\mathcal{R}_2}(z; U_2) \} \}$$

where $M_{\mathcal{R}_i}$ – the membership function of fuzzy relations $\mathcal{R}_i$.

For example,

$$\mathcal{R}_1 = \begin{pmatrix} 1 & 0.8 & 0.4 \\ 0.8 & 1 & 0.8 \\ 0.4 & 0.8 & 1 \end{pmatrix}, \quad \mathcal{R}_2 = \begin{pmatrix} 0 & 0.3 & 0.7 \\ 0.3 & 0 & 0.3 \\ 0.7 & 0.3 & 0 \end{pmatrix}$$

$$\mathcal{R}_1 \circ \mathcal{R}_2 = \begin{pmatrix} \inf(0; 0.8; 0.7) & \inf(0; 0.8; 0.4) & \inf(0; 0.8; 0.4) \\ \inf(0; 0.8; 0.7) & \inf(0; 0.8; 1; 0.8) & \inf(0; 0.8; 1; 0.8) \\ \inf(0; 0.4; 0.8; 1) & \inf(0; 0.4; 0.8; 1) & \inf(0; 0.7; 0.8; 1) \end{pmatrix} = \begin{pmatrix} 0.8 & 0.8 & 0.8 \\ 0.8 & 0.8 & 0.8 \\ 0.4 & 0.4 & 0.7 \end{pmatrix}$$

3) Maximultiplicative product of fuzzy relations $\mathcal{R}_1$ and $\mathcal{R}_2$.

We define it on the set $U$, denote it as $\mathcal{R}_1 \otimes \mathcal{R}_2$ and we will set the membership function defined by the formula:

$$M_{\mathcal{R}_1 \otimes \mathcal{R}_2}(U_1; U_2) = \sup \{ M_{\mathcal{R}_1}(U_1; z) \cdot M_{\mathcal{R}_2}(z; U_2) \}$$

where $M_{\mathcal{R}_i}$ – the membership function of fuzzy relations $\mathcal{R}_i$.

For example,

$$\mathcal{R}_1 = \begin{pmatrix} 1 & 0.8 & 0.4 \\ 0.8 & 1 & 0.8 \\ 0.4 & 0.8 & 1 \end{pmatrix}, \quad \mathcal{R}_2 = \begin{pmatrix} 0 & 0.3 & 0.7 \\ 0.3 & 0 & 0.3 \\ 0.7 & 0.3 & 0 \end{pmatrix}$$

$$\mathcal{R}_1 \otimes \mathcal{R}_2 = \begin{pmatrix} \sup(0; 0.24; 0.28) & \sup(0; 0.3; 0; 0.12) & \sup(0; 0.7; 0.24; 0) \\ \sup(0; 0.3; 0.56) & \sup(0.24; 0; 0.24) & \sup(0.56; 0; 0.3; 0) \\ \sup(0; 0.24; 0.7) & \sup(0.12; 0; 0.3) & \sup(0.28; 0; 0.24; 0) \end{pmatrix} = \begin{pmatrix} 0.28 & 0.3 & 0.7 \\ 0.56 & 0.24 & 0.56 \\ 0.7 & 0.3 & 0.28 \end{pmatrix}$$

4) Minimultiplicative product of fuzzy relations $\mathcal{R}_1$ and $\mathcal{R}_2$.

We define it on the set $U$, denote it as $\mathcal{R}_1 \ast \mathcal{R}_2$ and we will set the membership function defined by the formula:

$$M_{\mathcal{R}_1 \ast \mathcal{R}_2}(U_1; U_2) = \inf \{ M_{\mathcal{R}_1}(U_1; z) \cdot M_{\mathcal{R}_2}(z; U_2) \}$$

where $M_{\mathcal{R}_i}$ – the membership function of fuzzy relations $\mathcal{R}_i$.

For example,

$$\mathcal{R}_1 = \begin{pmatrix} 1 & 0.8 & 0.4 \\ 0.8 & 1 & 0.8 \\ 0.4 & 0.8 & 1 \end{pmatrix}, \quad \mathcal{R}_2 = \begin{pmatrix} 0 & 0.3 & 0.7 \\ 0.3 & 0 & 0.3 \\ 0.7 & 0.3 & 0 \end{pmatrix}$$

$$\mathcal{R}_1 \ast \mathcal{R}_2 = \begin{pmatrix} \inf(0; 0.24; 0.28) & \inf(0; 0.3; 0; 0.12) & \inf(0; 0.7; 0.24; 0) \\ \inf(0; 0.3; 0.56) & \inf(0.24; 0; 0.24) & \inf(0.56; 0; 0.3; 0) \\ \inf(0; 0.24; 0.7) & \inf(0.12; 0; 0.3) & \inf(0.28; 0.24; 0) \end{pmatrix} = \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$$

Such algorithms as elements of an aggregate system use the human brain to process data arrays. All such operations for our brain have imagery, meaning is not only abstract, but also creative, spiritual and spiritual. Therefore, many people, guided by fuzzy logic, find it
difficult to perceive clear logical structures. Various matrix products of relations to an abstract data set with a set of creative-humanitarian relations determine the effectiveness of the assimilation of the material. This is the essence of the humanization and humanitarization of mathematics in a technical university – the transition from pure abstraction to a visual and meaningful component.

Let's illustrate this statement with examples.

One of the main goals of studying mathematics by technical specialties at universities is to teach the creation of mathematical models, the development and study the analyzed processes, the development of systems and management methods.

The main task of creative, humanized learning is to develop students' curiosity, cognitive interest in the subject by adding imagery and spirituality to abstractions. One of the methods of updating attention is to create the beginning of the lesson, partially simulating the work of our brain.

During the lesson, it is very effective to establish the relationship between the activity of the left and right hemispheres of the brain in students. Abstract mathematical problems and examples become more vivid and understandable if they are associated with something interesting, familiar or non-standard.

3 Research results

Let's consider the process of humanization and humanitarization of the discipline "Mathematics" by the example of studying it by students of technical specialties. Such a topic, for example, as "Matrices" can be effectively connected with the humanities, for example, with history, as well as with the applied and practical orientation of the specialty.

After studying the lecture material, you can study matrices in practice as follows: fill in the matrix elements not with arbitrary numbers, but, for example, with dates from the history of the Fatherland, which every educated citizen needs to know.

Example 1.

Let the ACROS combine harvesters be purchased in enterprises 1-4 in the amount of 10, 07, 17, 09, respectively. The set of numbers given in the example is the date of the victory of the Russian army over the Swedes in the Battle of Poltava under the command of Peter the Great.

Let's assume that VECTOR-410 combine harvesters are purchased in enterprises 1-4 in the amount of 09, 08, 17, 14, respectively. The set of numbers given in the example is the date of the first victory of the navy over the Swedes at Cape Gangut under the command of Peter the Great in Russian history.

Let's assume that NOVA combine harvesters are purchased in enterprises 1-4 in the amount of 24, 12, 17, 90, respectively. The set of numbers given in the example is the date of the capture of the Turkish fortress of Izmail by Russian troops under the command of Alexander Suvorov.

To control the distribution of purchases, it is convenient to make the following table:

<table>
<thead>
<tr>
<th>Name of the combine harvester</th>
<th>Distribution by enterprises (units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACROS</td>
<td>1</td>
</tr>
<tr>
<td>VECTOR-410</td>
<td>09</td>
</tr>
<tr>
<td>NOVA</td>
<td>24</td>
</tr>
</tbody>
</table>
If we remove the names of rows and columns from this table, and enclose the remaining numeric values in parentheses, we will get an example of what is called matrices in mathematics:
\[ A = \begin{pmatrix} 10 & 07 & 17 & 09 \\ 09 & 08 & 17 & 14 \\ 24 & 12 & 17 & 90 \end{pmatrix}. \]

If it will be cancel the purchase of combine harvesters at enterprises 1 and 2, then this circumstance will lead to the disappearance of the first and second columns. We will get another example of a matrix where the specified dates of military glory will be associated only with the years of these events:
\[ B = \begin{pmatrix} 17 & 09 \\ 17 & 14 \\ 17 & 90 \end{pmatrix}. \]

Let table 1 show the purchase of new combine harvesters this year:
\[ A = \begin{pmatrix} 10 & 07 & 17 & 09 \\ 09 & 08 & 17 & 14 \\ 24 & 12 & 17 & 90 \end{pmatrix}. \]

Let the purchase of the same brands of combine harvesters for the same enterprises next year be given by the matrix:
\[ B = \begin{pmatrix} 21 & 09 & 13 & 80 \\ 09 & 05 & 19 & 45 \\ 07 & 07 & 17 & 70 \end{pmatrix}. \]

The rows of this matrix also display the days of military glory of Russia.

In order to prepare reports on the purchase of combine harvesters, it is required to determine the total amount of purchased grain harvesting equipment by position, this year and next:
\[ A + B = \begin{pmatrix} 10 & 07 & 17 & 09 \\ 09 & 08 & 17 & 14 \\ 24 & 12 & 17 & 90 \end{pmatrix} + \begin{pmatrix} 21 & 09 & 13 & 80 \\ 09 & 05 & 19 & 45 \\ 07 & 07 & 17 & 70 \end{pmatrix} = \begin{pmatrix} 31 & 16 & 30 & 89 \\ 18 & 13 & 36 & 59 \\ 31 & 19 & 34 & 160 \end{pmatrix}. \]

Let \( C = \begin{pmatrix} 05 & 12 & 19 & 41 \end{pmatrix} \) – matrix-string that determines the number of road and municipal equipment of the type: FENIX-800, FENIX MAX-800, CHEEGE-184, SNEGIR, purchased for four enterprises. The elements of the line-vector display the day of the beginning of the Soviet counteroffensive in the Battle of Moscow.

Let \( B = \begin{pmatrix} 10 \\ 11 \\ 9 \\ 8 \end{pmatrix} \) – vector-column that determines the costs of purchasing road and utility equipment, respectively, in millions of rubles. It is required to determine the total costs for the purchase of this equipment

Solution.
\[ A \cdot B = \begin{pmatrix} 5 & 12 & 19 & 41 \end{pmatrix} \cdot \begin{pmatrix} 10 \\ 11 \\ 9 \\ 8 \end{pmatrix} = (5 \cdot 10 + 12 \cdot 11 + 19 \cdot 9 + 41 \cdot 8) = 681. \]
With students who have a penchant for creativity, with the help of matrices, you can study the biography of outstanding people of art, analyze various data on the life and activities of creative people.

When studying the topic "Data Analysis", students took 50 poetic works of the great poet A.S. Pushkin to analyze the types of rhyming used. As a result, the following data were obtained: A. S. Pushkin used a paired rhyme in 20% of cases, a ring rhyme in 24% of cases and a cross rhyme in 56% of cases.

The results of the analysis of the poetic works of Alexander Pushkin are presented in Fig. 1.

![Fig. 1. Distribution of the percentage ratio of rhyming types in A. Pushkin's poems.](image)

Next, 35 poems by Mikhail Lermontov were considered. As a result, it was found that M. Lermontov used the ring rhyme least of all – 6%, in 34% of cases – paired and mainly cross-rhyme-60%.

The results of the analysis of the poetic works of Mikhail Lermontov are presented in Fig. 2.

![Fig. 2. Distribution of the percentage ratio of rhyming types in the poems of M. Lermontov.](image)

It is convenient to write the obtained results in matrix form:

\[
A = \begin{pmatrix}
20 & 6 \\
24 & 34 \\
56 & 60
\end{pmatrix}
\]

If a student of a technical specialty is passionate about history, or literature, or painting, or sculpture, or any other kind of art, then in a class, for example, in mathematics, he can be asked to come up with some problem from his favorite field. Here are examples of some problems developed by students of technical specialties during the study of the sections of mathematics "Combinatorics" and "Probability Theory":

1) Tasks according to the type of fairy tale.

The King and Queen are playing cards. But the cards are not ordinary, but endless! There are 4n cards in total, and therefore their game has been going on for more than one day. Both have forgotten about what sleep is, what the problems of the state are, and even what the
world is outside the room in which they have been sitting for the 6th day in a row. The Queen was already getting tired of this endless game, and therefore decided to play on the excitement: if the King has all 4 cards of the same suit in his hands, then he will have to give a quarter of all the lands of the Kingdom to her sister. Well, the King said goodbye to these lands. Is the probability of this event so great, or is it pure luck of the Queen?

It is required:
– To find the number of combinations in which the King can have cards of the same suit;
– Find the probability of this event.

2) Plot tasks.

At the most inopportune moment, as luck would have it, almost the entire city turned off electricity. Anton's workshop turned out to be one of the rooms that were affected by this incident. But the injustice is that the deadline for the commissioned portrait is burning, and at this very moment the final touches were left until it was ready. Working in the dark, Anton has to experience some difficulties. Taking out an almost empty flashlight and holding it in his teeth, he almost does not see what he is doing. The artist remembers the location of 5 colors on the palette, but can confuse them. To complete the order, 3 specific colors must be applied to the canvas. How many ways are there to apply colors to the canvas, if Anton mixes up all 5 colors, but does not forget that each color is on its own part of the palette?

3) The history of painting.

a) Vasily Surikov's teacher Pyotr Konchalovsky inadvertently confused his sketches with those of his student. It is known that Vasily could not keep up with his teacher, and therefore he made 2 times less out of 20 quick sketches of Konchalovsky. Determine what is the probability that out of 5 hastily taken from the set of sketches-3 belong to Vasily.

b) Dante Gabriel Rossetti's wombat is a lover of posing in paintings. In order to draw his favorite pet, Dante marked 6 positions on the floor, one of which the wombat had to sit on. Find the probability that the wombat will be in one of the positions.

Thus, using the above examples, we see that the built fuzzy connections between humanitarian, natural science and technical directions increase the interest and productivity of brain activity when studying the material at times.

4 Conclusions

The paper analyzes the need for humanization and humanitarization of technical education in higher educational institutions. The existing approaches of humanization are analyzed. The components of the model of information processing by the human brain are presented. The relationship between the use of these models and the increase in students’ motivation to learn is established. The mechanisms of translating the received information into knowledge by humanization are given. The paper presents examples of the application of these approaches. It is established that fuzzy logic, which is guided by both teachers and students, only little includes clear logical structures. Moreover, this inclusion is manifested in different people with different degrees of belonging. Therefore, when studying technical or other exact disciplines, with the skilful use by the teacher of the degree of such inclusion, students have the ability to show educational results that exceed their own capabilities.

5 Discussion

Experience shows that no skills, abilities, qualities of a person can be formed due to external influences alone; counter efforts of the personality of the future engineer are necessary. The task of the teaching staff of technical universities is to purposefully help the formation of
positive qualities of each student in unity with his professional knowledge and skills, to form
an emotionally elevated attitude to the Fatherland, to form a civil consciousness of the
personality of a citizen.

The new type of organization of education is dictated not only by the needs of society to
improve quality, but is determined by a more global social problem to bring the state of all
components of educational systems in line with the goals of humanization and
democratization of our society. The radical restructuring of the goals, content, methods and
technologies of education means that the scale of its influence on the individual should make
the process of professional training more effective and constructive precisely because it
affects all participants, both teachers and students [16-19]. In modern society, in recent years,
under the influence of innovative progress, there have been significant changes in the training
programs of technical students, the requirements for the system of business and personal
qualities of a future specialist are increasing. The humanization of social relations, attention
to the problem of education give the social characteristics of an engineer a special
significance. In an effort to activate students, teachers conduct a lot of educational work with
them, aimed at developing a conscious approach to the humanities studied at the university.
But, apparently, first of all, it is necessary to carry out directed systematic professional
education in the comprehensive teaching of all disciplines, to arouse interest in the specialty,
to suggest attractive professional tasks, linking their solution with the study of all academic
disciplines. A good specialist can only be a person who has deeply and firmly mastered
professional knowledge. Maybe this is also not enough to become a good engineer.
Professional knowledge should be supplemented by personal qualities and a creative
approach to business. Only in this case, the identity of the specialist will take place. A
specialist today is a skilled organizer who is able to apply the principles of scientific practice
in his work. This is a person who is able to work with a large team, a person of high culture,
erudition in various directions, a real intellectual. At each stage of human life, one of the
types of activity is the leading one, and this determines the peculiarity of the structure of self-
expression at this stage of personality development. Of course, the main activity of students,
which determines their social usefulness, social status, is cognitive or educational activity. In
a higher educational institution, cognitive activity is characterized not only by a certain level
of intelligence, scientific thinking, the amount of knowledge, but also by certain personal
factors: attitudes, interests, needs [20-24]. The concept of humanization of education is aimed
at forming a spiritually rich personality focused on universal values, with high professional
training, overcoming the technocratic narrow professional thinking of future specialists,
encouraging students to self-education, harmonious development of their abilities and talents,
as well as a patriotic attitude to the Fatherland, which will be the key to the formation of a
healthy society.

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