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THEORETICAL SUBSTITUTION OF THE METHOD FOR DETERMINING THE INTEGRATIVE INDICATOR OF INDISCIPLINITY OF CADETE-SEAMEN

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Abstract. Taking into account the negative impact of the human factor on shipping safety and the importance of the initial training of seafarers, where the foundation of their future professional reliability is formed, a list of $n=21$ characteristic features of indiscipline has been formulated, which more fully and comprehensively characterize this phenomenon. Indiscipline is understood as a deviation of the behavior of cadet sailors from the norms accepted in the educational society, which prevents the culprit himself and other cadets from learning, and the teacher from performing professional duties. Examples of a possible false transition of educational indiscipline into professional on a ship are given, which led to accidents and disasters.

Qualimetric indicators of indiscipline are introduced, determined by the normalized hazard coefficients of each trait, the frequency of its manifestation and the degree of expressiveness in a particular subject. The advantages of the multiplicative approach to obtaining a quantitative integrative assessment of indiscipline, which and only which is characterized by the systemic property of emergence, are substantiated. Recommendations are given for the fuzzification of the integrative quantitative assessment of the degree of indiscipline.

Xülasə. İnsan amilinin gəmiçiliyin təhlükəsizliyinə mənfi təsirini və dənizçilərin ilkin hazırlığının əhəmiyyətini nəzərə alaraq, onların gələcək peşəkar etibarlılığının təməli formalaşdırıldığı mərhələdə, $n=21$ intizamsızlıq xüsusiyyətindən ibarət siyahı tərtib edilmişdir. Bu siyahı bu fenomeni daha tam və hərtərəfli xarakterizə edir. İntizamsızlıq dedikdə, kursant-dənizçilərin davranışlarının tədris sosial mühitində qəbul edilmiş normalardan kənarlaşması nəzərdə tutulur ki, bu da həm günahkarın, həm də digər kursantların təhsil almasına mane olur, müəllimin isə peşəkar vəzifələrini yerinə yetirməsini çətinləşdirir. Tədris intizamsızlığının gəmidə peşəkar intizamsızlığa yanlış keçidinin mümkün nümunələri göstərilmişdir ki, bu da qəzalara və fəlakətlərə səbəb olmuşdur.

İntizamsızlığın normallaşdırılmış təhlükə əmsalları, hər bir xüsusiyyətin təzahür tezliyi və konkret sınaqdan keçirilən şəxsə ifadə dərəcəsi ilə müəyyən edilən kvalimetrik göstəriciləri təqdim edilmişdir. İntizamsızlığın kəmiyyət integrativ qiymətləndirilməsinin alınması üçün yalnız ona xas olan sistemli əmrəmətlilik xüsusiyyətinə malik olan multiplikativ yanaşma əsaslandırılmışdır. İntizamsızlıq dərəcəsinin lingvistik qiymətləndirilməsinə keçid üzrə tövsiyələr təqdim edilmişdir.

Key words: safety of navigation, human factor, coefficients of importance of indiscipline traits, frequency of manifestation and expressiveness, multiplicative aggregation, integrative assessment

Açar sözlər: gəmiçiliyin təhlükəsizliyi, insan amili, intizamsızlıq xüsusiyyətləri əhəmiyyət əmsalları, təzahür tezliyi və ifadəliliyi, multiplikativ aqreqasiya, integrativ qiymətləndirmə

Introduction. Statistics show that in the occurrence of accidents and disasters in complex field-ergatic organizational and active control systems (CFEOACS) «captain (crew as a whole) - ship –

environment» the «trigger» is the human factor (HF) [1-4, etc.]. And although today the reliability of the vessels themselves, the capabilities of their equipment, including automated control systems (ACS) and artificial intelligence (AI), the state of professional training of personnel, etc. are incomparably higher than they were, say, 50-70 years ago, the negative impact of HF on shipping safety has not changed significantly and, depending on the years of observation, causes at least $\frac{2}{3}$ - $\frac{4}{5}$ of the total number of accidents, disasters and serious incidents in maritime transport.

The above statistics become clear if we characterize the mentioned CFEOACS not only from the standpoint of system analysis, but also as a humanistic system. After all, according to the definition of Lotfi A. Zadeh, one of the founders of fuzzy mathematics, «humanistic systems are those systems whose behavior is greatly influenced by human judgments, perceptions, or emotions... The person himself (individual) and his thinking processes can also be considered as humanistic systems» [5]. From which it follows that any study of the impact of HF on navigation safety (NS) is relevant.

In the context of this publication, we will consider the negative impact of the HF on the NS through the prism of indiscipline (ID) of cadet sailors, as well as professional sailors. In this case, ID, taking into account [6-8], we will understand the deviation of the behavior of cadet sailors from the norms accepted in the educational society, which prevents the perpetrator and other cadets from learning, and the teacher from performing professional duties.

The fact of ID is revealed through the explication by cadet sailors of certain features. The list of $n=21$ characteristic features of ID (CFI), which today more fully and comprehensively covers and reveals the phenomenon under study, is presented in Table 1 [6-8].

Table 1

Characteristic features of indiscipline among cadet sailors,
manifested in the educational process

CFI _i	Content of the trait of indiscipline	CFI _i	Content of the trait of indiscipline
1	2	3	4
CFI ₁	Skips classes without respectable reasons	CFI ₁₀	Does not accept collective actions
CFI ₂	Believes that everything is wrong: criticizes the education system, equipment and in general everything that he sees	CFI ₁₁	Avoids work in classes
		CFI ₁₂	Does not follow instructions and does everything in his own way
CFI ₃	Hostile, picky, always ready for a quarrel and provokes it	CFI ₁₃	Does not try to help classmates or teachers in classes
CFI ₄	Excessively persistent, strives at any cost, even at the expense of friends, to complete the assigned task, extremely selfish	CFI ₁₄	Irresponsible, careless, careless in the use of equipment, untidy, tactless
CFI ₅	A waste of time, a talker, works with reluctance and slowly;	CFI ₁₅	Distracted, one whose thoughts are always not focused on the subject of study, confuses reality with fiction
CFI ₆	Timid (fear of friends and teachers), works alone, usually does not ask for help and does not strive for success	CFI ₁₆	Impulsive, seeks to get a result as soon as possible, without thinking about its correctness;
CFI ₇	Disinterested, always inattentive and quick	CFI ₁₇	Not independent, follows the opinion of his friends
CFI ₈	Arrogant know-it-all, sees little benefit from classes, self-teacher, "thinks his training system is better", talkative and talkative	CFI ₁₈	Systematically late for classes
		CFI ₁₉	Does not do homework
CFI ₉	Slow, always lacks time to finish work, although always does what is necessary	CFI ₂₀	Does not attend institution-wide, faculty-wide events
		CFI ₂₁	Returns literature to the library in a timely manner

Moreover, it seems possible to predict how the CFI inherent in an individual cadet may find further negative development during his work on the ship. The contents of Table 2 illustrate the correspondence of the CFI, manifested in the educational process, and the features of ID in professional activities (IDPA) of seafarers, which led to real undesirable events and accidents on the ship [8].

Table 2

Correspondence of the characteristic features of indiscipline in the training of young seafarers and their further professional activities (fragment)

CFI _i ⇒	FIPA _i ⇒	Content ⇒	Example of an accident, disaster
1	2	3	4
CFI ₁	FIPA ₁	Ignores protocols regarding the safe navigation of the vessel without proper justification	Vessel ran aground. MAIB report 7/2020 https://assets.publishing.service.gov.uk/media/5d93631a40f0b65e5ec0dd35/2019-12-Priscilla.pdf
⋮	⋮	⋮	⋮
CFI ₄	FIPA ₄	Shows excessive self-confidence and willingness to take risks without regard for the safety of the crew or the vessel in order to achieve his own goals, ignores clearly stated procedures approved by the company	Disadvantages of the crew training scheme MAIB report 4-2023. https://assets.publishing.service.gov.uk/media/64dce32e3fde61000d4a53bd/2023-4-MoritzSchulteReportAndAnnexes.pdf
CFI ₅	FIPA ₅	Careless performance of duties, wastes time or works slowly without proper regard for maintaining the vessel in proper condition with regard to the safe operation of the equipment	Lack of equipment maintenance MAIB report 6-2023 https://www.gov.uk/maib-reports/lifeboat-davit-failure-on-polar-research-vessel-rrs-sir-david-attenborough
⋮	⋮	⋮	⋮
CFI ₈	FIPA ₈	Ignores instructions and established procedures, believing himself to be an expert in steering the ship, shows self-confidence and excessive talkativeness when performing official duties	Violation of instructions for use of ship's equipment MAIB Report N08/2023 https://assets.publishing.service.gov.uk/media/6565cd7b62180b000dce82d0/2023-8-BBCMarmara-Report-Annex.pdf
⋮	⋮	⋮	⋮
CFI ₁₂	FIPA ₁₂	Ignores instructions from management and job descriptions, performs official duties with own interpretation or does not perform them at all	Negligent performance of official duties and failure to comply with maritime instructions.3bit MAIB 5/2023 https://www.gov.uk/maib-reports/collision-between-general-cargo-vessel-scot-explorer-and-gas-carrier-happy-falcon
⋮	⋮	⋮	⋮
CFI ₁₅	FIPA ₁₅	Loses attention when controlling the movement of the ship, especially when performing maneuvering elements, cannot clearly direct attention to the performance of the duties of the shipmaster during the movement of the ship, may lead to mistakes in steering the ship or other dangerous situations	Neglect COLREG. Self-confidence when making a decision when maneuvering a vessel MAIB report No7 - 2020 https://assets.publishing.service.gov.uk/media/5e70e50dd3bf7f2693249b81/2020-7-ANLWyongKingArthur.pdf
⋮	⋮	⋮	⋮

Unfortunately, researchers and specialists who deal with the problems of NS and its management precisely from the perspective of the influence of the HF do not pay due attention to the lack of discipline among seafarers, which artificially creates certain «false links» in a continuous chain of interconnected factors that should ensure the proper level of the specified safety.

Formulation of the issue. As we can see from the above, indiscipline (ID) as a phenomenon is a multifaceted and relevant phenomenon that can negatively affect not only the educational process, but also the NS. Therefore, an important stage of its research during the initial professional training of young seafarers in an educational institution is to obtain an appropriate integrative assessment, which and only which is characterized by the systemic property of emergence [10-13, etc.] and which will allow studying this phenomenon from a single position, and therefore developing more effective antidotes. Thus, the *purpose* of this publication is to develop a systematic methodology for the integrative assessment of ID of cadet sailors in the educational process. For this, the following tasks should be solved:

- establish the components of the integrative assessment of ID and methods of their qualimetry;
- substantiate the approach to the aggregation of individual dimensions of ID into an integrative indicator;
- develop recommendations for establishing the degree of ID of cadet-sailors.

Analysis of the results achieved. Based on the content of works [11-17, etc.], we will introduce the following indicators of indiscipline that should be aggregated into an integrative assessment: $\varphi_{Haz.}(ID)$ – danger indicator (hazard) ID; $\varphi_{Freq.}(ID)$ – frequency of occurrence ID; $\varphi_{CB}(ID)$ – expressiveness indicator (EI) ID. And if we assume that the listed indicators can be quantitatively measured on a single scale, then, taking into account the results of studies [11-13, 15-18, etc.], the integrative indicator of ID will have the following form::

$$\begin{aligned}\varphi(ID) &= \varphi\left(\varphi_{Haz.}(ID), \varphi_{Freq.}(ID), \varphi_{CB}(ID)\right) = \\ &= \sqrt[3]{\varphi_{Haz.}(ID) \cdot \varphi_{Freq.}(ID) \cdot \varphi_{CB}(ID)}.\end{aligned}\quad (1)$$

Thus, from the point of view of system analysis, we are talking about solving a one-step decision-making task (DM) with a vector efficiency indicator. In this case, we note that the multiplicative aggregation of the components of the integrative assessment of the ID of cadet sailors, defined by the last part of expression (1), is, in essence, a development of the «desirability function» of Harrington [17.] and has the following advantages [10-12, 14-16, 18, etc.]: 1) a more cautious result is obtained in relation to additive aggregation, and therefore a more reliable result; 2) formula (1) really interprets a quantitative, unambiguous, single and universal indicator of the integrative assessment of ID; 3) multiplicative aggregation of the type (1) has the properties of adequacy, efficiency and statistical sensitivity, therefore it can be used as an optimization criterion; 4) helps to prevent errors of the I-II kind in determining the indicator $\varphi(ID)$.

If you measure the indicators $\varphi_{Haz.}(ID)$, $\varphi_{Freq.}(ID)$ and $\varphi_{EI}(ID)$ on an absolute scale, as, $Sc=[0, 1]$, then the measurement of the integrative indicator ID $\varphi(ID)$ will also take place in the same absolute scale, very convenient for representation and interpretation in the human mind. Which can be formally presented as follows:

$$\{(\varphi_{Haz.}(ID) = [0,1]) \cap (\varphi_{Freq.}(ID) = [0,1]) \cap (\varphi_{EI}(ID) = [0,1])\} \Rightarrow \varphi(ID) = [0,1]. \quad (2)$$

Let's take a closer look at the technology for measuring indicators $\varphi_{Haz.}(ID)$, $\varphi_{Freq.}(ID)$ $\varphi_{CB.}(ID)$ in absolute scale.

1. Qualimetry of the indicator $j_{Haz.}(ID)$. So, even a superficial analysis of the list of CFIs presented in Table 1 indicates their different danger (harm) for the educational process. Therefore,

using known expert methods and procedures, it is easy to obtain individual systems of preferences (SP) of scientific and pedagogical workers on the set of studied CFIs. In this case, by SP we will understand an ordered series of CFIs: from more significant, important, dangerous from the standpoint of negative impact on the educational process, to less significant. Further applying such a strategy of group decisions as summing and averaging ranks, it is easy to obtain a group SP (GSP) on the set of CFIs [7, 11, 14, 18 та ил.].

By implementing a multi-step technology for identifying and filtering out marginal opinions, as well as eliminating the so-called «survivor bias», also known as the «paradox of information availability» [14, 18-21, etc.], we obtain a «base» GSP that will satisfy a set of system-information criteria for consistency [14, 18, 21, 22, etc.]. Its optimization using the Kemeny median leads to a «reference» GSP [15, 24-27, etc.]. Thus, each studied CFI_i , $i = \overline{1, n = 21}$ a completely justified rank is put in correspondence: $CFI_i \Rightarrow r_{CFI_i}^{et.}$. Based on the specified «reference» GSP, and therefore, it is not difficult to defuzzify them using the mathematical method of prioritization (MP), also known as the «leader problem» [10-12, 14-16, 22, 27, 28, etc.], that is, to assign a normalized weight coefficient (NWC) to each and every CFI under study:

$$\begin{cases} CFI_i \Rightarrow r_{CFI_i}^{et.} \xRightarrow{MP} \alpha_{CFI_i}(r_{CFI_i}^{et.}) \\ 0 \leq \alpha_{CFI_i}(r_{CFI_i}^{et.}) \leq 1; \quad \sum_{i=1}^{n=21} \alpha_{CFI_i}(r_{CFI_i}^{et.}) = 1, \end{cases} \quad (3)$$

where $r_{CFI_i}^{et.}$, $\alpha_{CFI_i}(r_{CFI_i}^{et.})$ – rank insignia CFI_i in the reference GSP and its corresponding NWC.

However, referring to the IMO recommended qualitative (linguistic) criteria for hazard levels (HL) in shipping [13], we present them using the fuzzy mathematics methodology as a term set (T^S) of the corresponding linguistic variable (LV):

$$T^S(HL) = \overset{\tilde{R}_C}{Catastrophic} + \overset{\tilde{R}_{Sev.}}{Severe} + \overset{\tilde{R}_{Sig.}}{Significant} + \overset{\tilde{R}_{Mi}}{Minor} = \tilde{R}_C + \tilde{R}_{Sev.} + \tilde{R}_{Sig.} + \tilde{R}_{Mi}, \quad (4)$$

Where: $\tilde{R}_k$ – mark of the k -th linguistic assessment of the «HL» scale of the type (4), $k = \overline{1, K = 4}$;

«+» – mark of logical combination of grades $\tilde{R}_k$ into a scale.

And since the ranking of scale scores (4) by danger is obvious:

$$\tilde{R}_C > \tilde{R}_{Sev.} > \tilde{R}_{Sig.} > \tilde{R}_{Mi}, \quad (5)$$

then this facilitates the use of the same MP to determine the NWC of the studied CFIs:

$$\begin{cases} CFI_i \Rightarrow HL_{ik} / \tilde{R}_{ik} \xRightarrow{MP} \alpha_{CFI_i}(\tilde{R}_{ik}), \quad k = \overline{1, K = 4} \\ 0 \leq \alpha_{CFI_i}(\tilde{R}_{ik}) \leq 1; \quad \sum_{k=1}^{K=4} \alpha_{CFI_i}(\tilde{R}_{ik}) = 1. \end{cases} \quad (6)$$

It is clear that the indicators $HL_{ik} / \tilde{R}_{ik}$ are determined by experts.

So, having indicators $\alpha_{CFI_i}(r_{CFI_i}^{et.})$ и $\alpha_{CFI_i}(\tilde{R}_{ik})$, there is a refined integrative hazard indicator for each studied CFI_i :

$$\varphi_{Haz.}(CFI_i) = \sqrt{\alpha_{CFI_i}(r_{CFI_i}^{et.}) \cdot \alpha_{CFI_i}(\tilde{R}_{ik})}. \quad (7)$$

2. Qualimetry of the indicator $j_{Freq.}(ID)$. The same IMO document [14] defines not only qualitative (linguistic) indicators HL, but also the frequency levels of undesirable / dangerous events on the ship (Frequency's Level, - FL), which again, using the methodology of fuzzy mathematics,

will be presented in the form of T^S of the corresponding LV.

$$T^S(FL) = \tilde{R}_F + \tilde{R}_{RP} + \tilde{R}_R + \tilde{R}_{ER} = \tilde{R}_F + \tilde{R}_{RP} + \tilde{R}_R + \tilde{R}_{ER}, \quad (8)$$

where $\tilde{R}_l$ – mark of the l -th linguistic assessment of the «FL» scale of the type (8), $l = \overline{1, L=4}$;

«+» – mark of logical combination of grades $\tilde{R}_l$ into a scale.

As we can see, the «FL» scale of the form (8) yields a trivial ranking of its ratings:

$$\tilde{R}_F > \tilde{R}_{RP} > \tilde{R}_R > \tilde{R}_{ER}, \quad (9)$$

which again opens up prospects for establishing the NWC of the scale components (8):

$$\begin{cases} CFI_i \Rightarrow FL_{il}/\tilde{R}_{il} \xrightarrow{MP} \alpha_{CFI_i}(\tilde{R}_{il}), & l = \overline{1, L=4} \\ 0 \leq \alpha_{CFI_i}(\tilde{R}_{il}) \leq 1; & \sum_{l=1}^{L=4} \alpha_{CFI_i}(\tilde{R}_{il}) = 1. \end{cases} \quad (10)$$

Naturally, for every j th cadet-sailor ($j = \overline{1, m}$) a specific indicator of the frequency of explication of each should be established CFI_i : $\forall j: \alpha_{CFI_i}(\tilde{R}_{il}^{(j)})$.

3. Qualimetry of the indicator $j_{EI}(ID)$. However, each studied CFI_i in relation to a specific tested cadet sailor, it is recognized not only by the frequency of manifestation, but also by the degree of expressiveness (EI), which can also be assessed by the following linguistic scale:

$$\begin{aligned} T^S(EI) &= \tilde{R}_{VH} + \tilde{R}_H + \tilde{R}_A + \tilde{R}_L + \tilde{R}_{VL} = \\ &= \tilde{R}_{VH} + \tilde{R}_H + \tilde{R}_A + \tilde{R}_L + \tilde{R}_{VL}, \end{aligned} \quad (11)$$

where $\tilde{R}_p$ – mark of the p -th linguistic assessment of the «EI» scale of the type (11), $p = \overline{1, P=5}$;

«+» – mark of logical union of grades $\tilde{R}_p$ on a scale.

In scale (11) there is also a trivial ranking of her linguistic assessments:

$$\tilde{R}_{VH} > \tilde{R}_H > \tilde{R}_A > \tilde{R}_L > \tilde{R}_{VL} \quad (12)$$

which again allows us to apply the MP to determine the corresponding NWCs for the indicators of the CFI scale (11):

$$\begin{cases} CFI_i \Rightarrow EI_{CFI_i}/\tilde{R}_{ip} \xrightarrow{MP} \alpha_{CFI_i}(\tilde{R}_p), & p = \overline{1, P=5} \\ 0 \leq \alpha_{CFI_i}(\tilde{R}_p) \leq 1, & \sum_{p=1}^{P=5} \alpha_{CFI_i}(\tilde{R}_p) = 1. \end{cases} \quad (13)$$

Thus, the normalized integrative indiscipline indicator of the j -th cadet sailor, associated with the explication CFI_i , will be determined as follows:

$$\begin{aligned} j_j(CFI_i) &= \sqrt[3]{a_{CFI_i}(\tilde{R}_l^{(j)}) \Psi_{CFI_i}(\tilde{R}_p^{(j)}) \Psi_{Haz.}(CFI_i)} = \\ &= \sqrt[3]{a_{CFI_i}(\tilde{R}_l^{(j)}) \Psi_{CFI_i}(\tilde{R}_p^{(j)}) \sqrt[3]{a_{CFI_i}(r_{CFI_i}^{et.}) \Psi_{CFI_i}(\tilde{R}_{ik})}}. \end{aligned} \quad (14)$$

Then the integrative indicator of the level of indiscipline of the j -th cadet across the entire spectrum of the studied CFIs will be:

$$j_j(CFI) = n \cdot 21 \sqrt[n-21]{\prod_{i=1}^{n-21} j_j(CFI_i)} = n \cdot 21 \sqrt[n-21]{\prod_{i=1}^{n-21} \sqrt[3]{j_{Haz.}(CFI_i) \Psi_{CFI_i}(\tilde{R}_l^{(j)}) \Psi_{CFI_i}(\tilde{R}_p^{(j)})}} = \quad (15)$$

$$= n \cdot 21 \sqrt[n-21]{\prod_{i=1}^{n-21} \sqrt[3]{a_{CFI_i}(r_{CFI}^{et.}) \Psi_{CFI_i}(\tilde{R}_{ik}) \Psi_{\text{II}}^{CFI_i}(\tilde{R}_l^{(j)}) \Psi_{CFI_i}(\tilde{R}_p^{(j)})^{\text{III}}_{\text{BI}}}}$$

Let's fuzzify the indicators $j_j(CFI)$. To do this, we construct their distribution, assuming that it is normal (fig.). Applying further the methodology of fuzzy mathematics, including the modifier «very», we construct the T^S LV «degree of ID (DID)»:

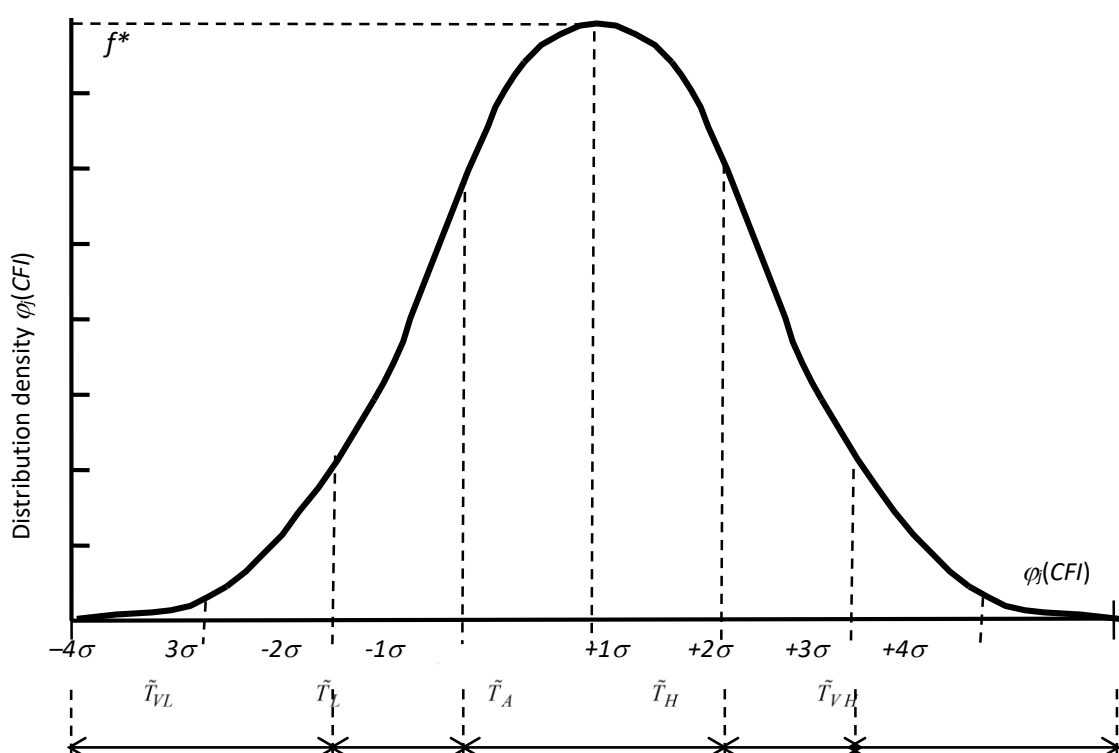


Fig. Illustration of fuzzification of integral quantitative indicators of the degree of indiscipline of cadet sailors for the example of the normal law of their distribution

$$T^S(DID) = \overset{\tilde{T}_{VH}}{\text{Very High}} + \overset{\tilde{T}_V}{\text{High}} + \overset{\tilde{T}_A}{\text{Average}} (\overset{\tilde{T}_L}{\text{Like Most}}, \overset{\tilde{T}_{VL}}{\text{Normal}}) + \text{Low} + \text{Very Low} = \quad (16)$$

$$= \tilde{T}_{VH} + \tilde{T}_H + \tilde{T}_A + \tilde{T}_L + \tilde{T}_{VL},$$

Where $\tilde{T}_q$ – mark of the q -th linguistic assessment of the «DID» scale of the type (16), $q = \overline{1, Q=5}$;

«+» – mark of logical union of grades $\tilde{T}_q$ on a scale.

Taking into account the features of the normal distribution, the criteria for fuzzification / defuzzification of the integral indicators of the DID of cadet sailors are presented in Fig. Thus, a truly methodologically provided quantitative and qualitative analysis of the integrative indicators of their ID in the educational process.

Conclusions. Summarizing the new scientific results obtained and presented in this publication on the development of theoretical foundations of the methodology for obtaining an integrative assessment of the ID of cadet sailors, we draw attention to the following more important provisions.

1. Indiscipline is a multifaceted and relevant phenomenon that can negatively affect not only the educational process of cadet-marines but also (NS). A list of $n = 21$ CFIs has been formulated, which currently provides a more comprehensive and thorough representation of the phenomenon in the educational process. Using examples of real accidents and disasters, the potential for ID to transition from the educational process into the professional activities of seafarers has been demonstrated.

2. It has been established that the integrative indicator of ID, which uniquely possesses the systemic property of emergence, must encompass the hazard indicator of CFI $\varphi_{Haz.}(ID)$, their frequency of manifestation $\varphi_{Freq.}(ID)$ and EI $\varphi_{EI}(ID)$ for each cadet-mariner. In turn, the $\varphi_{Haz.}(ID)$ indicator is composite and generalizes both the hazard of CFI_i, which depends on its rank in the "reference" GPS, and the hazard determined by IMO criteria. Similarly, the $\varphi_{Freq.}(ID)$ indicator is determined through expert evaluation based on IMO criteria. Using the «very» modifier, a linguistic scale for the qualimetry of the $\varphi_{EI}(ID)$ indicator has been constructed.

3. The possibility of applying the mathematical MP, also known as the «leader problem» has been substantiated for determining the quantitative NWC of the indicators $\varphi_{Haz.}(ID)$, $\varphi_{Freq.}(ID)$ and $\varphi_{EI}(ID)$, and, consequently, the integrative indicators both for individual traits $\varphi_j(CFI_i)$, and across their entire spectrum $\varphi_j(CFI)$. In other words, partial and integrative ID indicators are measured on an absolute scale $Sc=[0, 1]$, which facilitates their clear representation and interpretation in human cognition.

4. The task of obtaining an integrative assessment of ID for cadet-marines is considered from the perspective of systems analysis as solving a single-step DM problem with a vector efficiency indicator. The multiplicative aggregation of partial ID indicators is substantiated, and its inherent advantages are presented.

5. Recommendations have been developed for the reverse fuzzification of integrative ID indicators in the educational process, ensuring their comprehensive quantitative and qualitative analysis.

6. Thus, a generalized conclusion can be made that the objectives of this publication have been achieved, and the goal has been accomplished. Further research should be conducted in the following directions (not ranked):

- Practical implementation of the theoretical provisions we have developed for the qualimetry of ID in cadet-marines;
- Development of countermeasures for correcting ID in cadet-marines, including through the use of professional situational exercises.

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