Mathematical Models of Group Dynamics When Working in Teams of Developers of Training Distance Courses

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Abstract

The study examines the actual problem of improving the mathematical models of group dynamics of the formation of teams of developers of distance courses. These mathematical models use real models to describe the process of creative interaction of team members and consider their psychological types in the real conditions of the educational institution. From the point of view of the theory of research of mathematical models of group dynamics of interaction of team members, it should be recognized that the various results of research obtained in psychology and sociology on the coordination of teams of distance learning course developers, which describe formal models today, are not fully reflected by scientists. We believe that a promising direction is to expand the categories of educational tasks using dynamic mathematical models of group dynamics for their further application in research. It should be noted that the main criterion used to study the mechanism of innovative approach to the development of distance learning courses is dynamic mathematical modeling of group dynamics. On the one hand, the use of mathematical models of group dynamics allows you to make reasonable conclusions and establish a quantitative relationship between the main phenomena and internal processes. At the same time, on the other hand, it should be remembered that in the construction of any mathematical model of group dynamics in the formation of teams of distance learning course developers will be introduced many logical elements.

Keywords 1

Mathematical models, group dynamics, teams, developers, training, distance, courses.

1. Introduction

In today's information society, the focus is on a set of innovative activities for the development of distance learning courses aimed at the rapid acquisition and use of reliable data, which are exhaustive and timely for sectors of human activity [26, 29]. The main purpose of the modern informatization of society is the creation of distance learning courses in order to effectively support production processes (business logic), contributing not only to the avalanche-like scientific and technological progress, but also to create an innovative information environment to support management decisions in the field of educational process [16, 33]. The main criterion for the informatization of modern society is the creation of software and hardware platforms for the rapid development of the necessary educational material with subsequent processing by students, as well as the transfer and storage of ultra-large information data streams, including the use of independent computing platforms [7, 19, 31]. In modern scientific publications related to the topic of the article, many scientists pay attention to the methods of group

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interaction in the development of distance learning courses, using the methods of group dynamics [11, 27, 39]. One of the relevant aspects, to which less attention is paid, is the analysis of the influence of the size and structure of the team on the choice of implemented methods of formation and their impact on achieving positive results in the development of distance learning courses in improving the learning process using innovative methods in the educational process [1, 18, 23, 36]. Today, under current conditions and constraints, many authors continue to conduct scientific and practical research on the use of group dynamics models, in particular on adaptive dynamic mathematical models and areas of their effective application [4, 5, 12, 20, 21]. Among such famous scientists it is necessary to list the following names as A. H. Almaas, Richard Rohr, Claudio Naranho, Don Richard Riso and Ras Hudson, Elizabeth Weiglia, Ginger Lapid-Bogd, Helena Macan. The main direction of the development of the post-productive society in Ukraine is the educational sector based on the use of innovative competitive technologies, which are actively developing as the use of innovative information technologies significantly increases the use of professional knowledge and competencies in various fields due to the modernization of technological processes and approaches to the nature of labor, in particular , reducing the ratio of mental physical labor, minimizing the impact of human errors by automating business processes [22, 28, 40]. The research methods are based on the use of systemic analysis of literary and scientific sources in the context of the relevance of the scientifically applied problem; adaptive methods for determining the competence of applicants to members of the developers of remote training courses; methods of dynamic programming to determine the training speed and acquisition of professional competences of team members; mathematical methods of the dynamic functioning of software systems for effective use in the tasks of a wide range of management of socio-economic systems; Methods of making management decisions for the formation of effective teams on the development of remote educational courses [2, 3, 15, 34].

2. Cost allocation model for the team to solve the task of developing a distance learning course

Model of a single-strategy team of software system developers that uses a single software and hardware resource, the total cost of obtaining it depends on the volume of activities that are selected by the team members [14, 37]. A reasonably stable functioning of the command is the existence of such a procedure for distribution of the resource, for which it is possible to select the members of such a vector of non-zero daughters, which would be unilaterally stable according to Neshu (stable with respect to the individual deviation of its members) and efficient according to Pareto (advantageous for the team as a whole). So, the main results of resource cost allocation are that:

1. it is known that for flat cost allocation procedures, the sustainable functioning of the team is impossible;
2. it is proved that if the members of a homogeneous team are such that they can be ordered by performance and it does not depend on “production volumes”, then the sustainable functioning of the team is also impossible;
3. it is substantiated that the condition for the sustainable functioning of a team is the presence of synergistic interaction of its members.

Model:

$$f_i(x, r_i) = h_i(x_i, r_i) - \lambda_i(x), \qquad i \in N \tag{1}$$

whare $C(X)$ expenses,

$$X = \sum_{i \in N} x_{i.} \tag{2}$$

ypothesis:

1. $\forall\, i \in N,\ \forall\, x \in \Re_+^n\ \ \lambda_i(x) \geq 0.$
2. $\forall\, i \in N,\ \forall\, x \in \Re_+^n\ \ \lambda_i(x)$ does not decrease in the sale x_i.
3. $\forall\, x \in \Re_+^n\ \ \sum_{i \in N} \lambda_i(x) = C(X).$
4. $\forall\, i \in N,\ \forall\, r_i \in \Omega_i\ \ h_i(0, r_i) = 0.$
5. $\forall\, i \in N,\ \forall\, x_{-i} \in \Re_+^{n-1}\ \ \lambda_i(x_{-i}) = 0.$
6. $C(\cdot)$ an inconsistent function $C(0) = 0.$
7. Income function and cost function - linear

Problem: $\exists\ \lambda(\cdot)-?:\ \forall\ r \in \Omega\ \ P(r) \subseteq E_n(\lambda(\cdot), r)$.

Condition of the synergistic effect:

$$\max_{x \in \Re_+^n} [\sum_{i \in N} h_i(x_i, r_i) - C(X)] \geq \sum_{i \in N} \max_{y_i \geq 0} [h_i(y_i, r_i) - C(y_i)]. \tag{3}$$

So, on the basis of the above mathematical models we can note that when using the cost allocation procedure, the mutual awareness of team members of distance learning course developers is important, and the vector of team member types should not be known to everyone, because the "condition of stability" for each team member contains only its psychotype. The synergy condition (3) covers the types of all team members, but it should be tested, earlier, at the stage of synthesis of the cost allocation mechanism (creation of conditions for distance learning course development team activities) and requires only the necessary knowledge of the true vector, the types of distance learning course development team members, and not resisting any reflection [10, 17, 33, 38]. So, the main results of the study of cost allocation procedures for the development of innovative distance courses are that:

1. first, it is shown that with linear cost allocation procedures, the sustainable functioning of the team is impossible;
2. secondly, it is proved that if the members of a homogeneous team are such that they can be ordered by their performance, and it does not depend on the "volume of tasks", then the sustained functioning of the team is impossible (the presence of absolute leaders in the team destroys the "homogeneous" team)
3. thirdly, it is substantiated that the condition for sustainable functioning of a team is the presence of synergetic interaction of its members.

3. Model of effective adaptation of development teams of distance learning courses

As noted above, one of the key differences between teams of distance learning course developers and organizations is that in the former, despite the presence of a leader (usually informal), there is no formal hierarchy. Let us consider models of self-adaptation of teams of distance learning course developers to dynamically changing conditions. Adaptation is closely related to self-development and self-organization. Self-development is understood as the direction of self-improvement of professional competencies of the members of distance learning course development teams, associated with the transition to a higher level of functioning of relationships [6, 8, 9, 13, 30]. The process of self-improvement is understood as a change in the professional state of a team member of distance learning course developers under the influence of inherent contradictions, factors and conditions. At the same time, external influences play a modifying and indirect role. A more general notion of self-improvement is the self-organization of the process of development of distance learning courses, during which the structure of complex information relationships is created, reproduced or improved. Note also the peculiarity that the inherent phenomenon of independent selection by team members and the performance of their functions, as well as the scope of the tasks described above. The models can be interpreted as the self-organization of a team of distance learning course developers in contrast to the centralized organization of activities carried out in hierarchical organizational systems by the governing body.

Adaptation (from Latin Adaptatio – "adaptation") - adaptation to the conditions of existence and adaptation to them; in social systems a type of interaction with the environment, during which the requirements and expectations of all members of teams of developers of distance learning courses are coordinated. Within the models of formation of teams of developers of distance learning courses using information technology under adaptation we will understand the process of changing the actions (including in the general case the functions and the volume of completed tasks) that the team members choose based on current information in a dynamically changing environment (Figure 1) [24, 35]. In practice, we can distinguish several nested levels of adaptation for members of distance learning course development teams:

1. Change in awareness;
2. Change of behavior as actions that are selected on the basis of available information;
3. Change of parameters of the system, which allows implementing more efficient behavior when conditions change;

4. Purposeful change of the external environment (active adaptation).

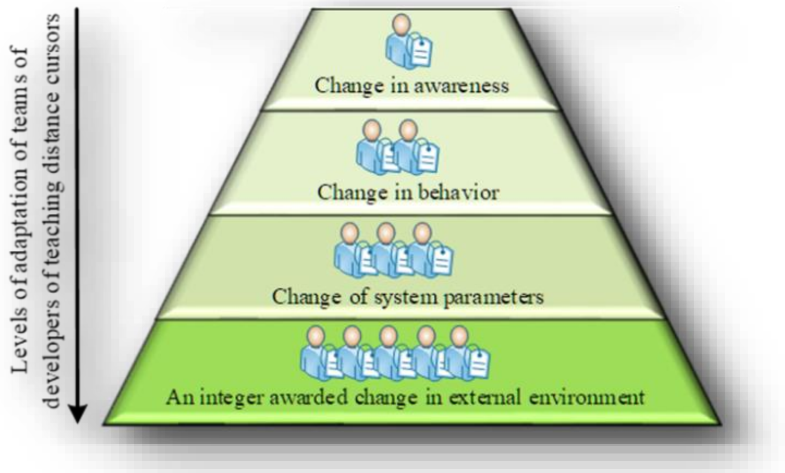

Figure 1: Levels of adaptation of distance learning course development teams

Distance learning course development team members are rational, their interests are described by their goal functions, and the rationality of each team member's behavior is to maximize their goal function, but at each iteration of time their worked-out decisions are made under conditions of incomplete information. Over time, they accumulate information about fuzzy uncertain parameters, and different "strategies" of distance learning course development team members' behavior in terms of the goals they have can be used.

4. Formation of a structural model for the adaptation of teams of distance learning course developers

The specificity of teams of developers of distance learning courses lies, in particular, and in the fact that each team member as information to adjust their perceptions of uncertain parameters can use only the results of observation of the external environment, but also conclusions about the actions and other team members, trying to "explain" why they chose this particular strategy of action (Figure 2). Let us define the interval of time during which the general adaptation of the team members to the positive relationship between us takes place.

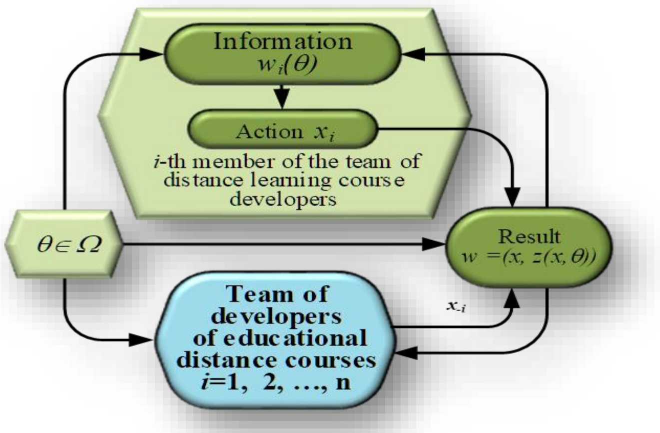

Figure 2: Structure of the adaptation period model of teams of distance learning course developers

$\pi(x) = \{\theta \in \Omega | \exists\, \Omega_0 : \theta \in \Omega_0, x \in E(\Omega_0)\}$ is the set of nature states in which the studied vector of the distance learning course team member is equilibrated? So, $g = (g_1, g_2, \dots, g_n) \in \Re^n$ is the vector investigated as a property of the software development team member, and the value of its target function. Therefore, the mathematical condition is $\delta(g, z) = \{\theta \in \Omega | f_j(\theta, z) = g_j, j \in N\}$, the set of those values of the ambient states in which the winning strategies of the team member under study can be positively realized with result z.

So, $p(x,z) = \{\theta \in \Omega | G(\theta,x) = z\}$ – where $p \subseteq \Omega$ is the set of values of states of nature at which the observed vector of actions of the distance learning course development team member leads to that result value *z* that is under investigation.

The *i*-th member of the distance learning course development team has at least four independent sources of information about the state of nature:

1. A priori personal information $w_i(\theta) \subseteq \Omega$.
2. The actions of other members of distance learning course development teams by observing them and assuming that they will act rationally. In this case a team member can (assuming that there is common correct knowledge at the first level of the awareness structure) carry out reflection evaluating the received information $p(x)$ about the state of the nature under study, on the basis of which the colleagues' rational choice of these very actions was made.
3. The successful accomplishment of those or other tasks by the members of the g team of distance learning courses developers, who act on the basis of this information can draw an adequate conclusion $\delta(g,z)$ about those or other states of nature, in which the total result contributes to the observed positive results of the accomplishment of the task set.
4. The result of joint activity of a team of distance learning course developers using cloud technologies, which just contributes to the appearance of the desired result $p(x,z) = \{\theta \epsilon \Omega \mid G(\theta,x) = z\}$.

Let's note that because of the introduced assumption, the information of items 2-4 is common knowledge among the team members, i.e. from the point of view of each other they, observing the same information events, must equally (and predictably for the opponents) change their ideas about the productive environment. That is, in general obtained knowledge is the information given in the expression:

$$I(x,z,g) = \pi(x) \cap p(x,z) \cap \delta(g,z) \subseteq \Omega. \quad (4)$$

This is a mathematical assumption, along with the assumption that each team member believes that there is general knowledge taken out of consideration (but not subsequent objects of study) reflecting the opponents' agentic awareness at the first level of the awareness structure.

5. Models for distribution of functional responsibilities within the teams of distance learning course developers

The study considers the concept of "task allocation", which is conditional and covers a wide range of categories of optimization tasks, including tasks that form the professional composition of the team, tasks that allocate functional responsibilities (roles) in heterogeneous teams, and the volume of tasks. It is assigned within the team. These three types of tasks are interrelated and are solved "periodically". Therefore, to form an effective team of software system developers it is necessary to know what function will be performed by this or that participant performing this team, and for the best distribution of functions it is necessary to know how many tasks are recommended to perform. A specific function is performed for that participant or participant within a specific function.

So let's consider in turn the tasks of load sharing, the tasks of function allocation, and the tasks of creating an effective command staff for these tasks.

6. Dynamic model of adaptation of developer commands of training distance course for infocommunication systems

If team members repeatedly select their actions, they can gain "reuse" information by observing the work of other members of the distance learning course development team. Suppose that team members select their actions at each step simultaneously, and the time interval is the same.

So, $x_i^t \in X_i$ – the fulfillment of the set tasks by i-th member of the team of distance learning courses developers at a certain point in time t, and $r^{1,t}$ – the synergistic effect of vector associations of all members of the team of distance learning courses developers for a fixed period (time quanta). Thus, by the end of the total period T the weighted value of information for all members of the team of distance learning course developers is information (5):

$$I(x^t,z^t,g^t) = \pi(x^t) \cap \ p(x^t,z^t) \ \cap \delta(g^t,z^t) \subseteq \Omega. \quad (5)$$

In the next step, we will evaluate a member of the cloud-based distance learning course development team for overall task completion status (6):

$$J_i^t(\omega_i, x^{1,t}, z^{1,t}, g^{1,t} = \omega_i \cap \bigcap_{\tau=1}^{t} I(x^{\tau}, z^{\tau}, g^{\tau}) . \quad (6)$$

Example of a case of Kurno oligopoly model:

$$\text{If,}\ \ n = 2,\ x_i \geq 0,\ i = 1, 2, \dots, n, \quad z = x_1 + x_2, \Omega = [1; 4]; \quad (7)$$

$$\omega_i = [2, 5] \qquad \theta_j = 3, f_j(\theta, z) = (\theta - \alpha z)z - x_i^2 r / 2, \quad (8)$$

where $\alpha > 0, r > 0$ – are known dimensional constants. Assuming that each member of the team of distance learning course developers observes only his actions and strives only for a positive result from his activity, and if the value of the objective state for victory was initially known, he would have to choose the following sequence of actions:

$$x_i^*(\theta) = \frac{\theta}{4\alpha + r}, \qquad i = 1, 2, \dots, n. \quad (9)$$

In this case, the state of behavior of members of teams of developers of distance learning courses will look like this:

$$\theta_i^t = \frac{\left(\theta_0 - \alpha(x_1^t, x_2^t)\right)(x_1^t, x_2^t)}{2x_i^t} + 2\alpha x_1^t, \qquad i = 1, 2, \dots, n, t = 1, 2, \dots, m. \quad (10)$$

Based on the theoretical considerations above, members of cloud-based distance learning course development teams will choose the following ways to make appropriate production decisions:

$$x_i^t\left(\theta_i^{t-1}\right) = \frac{\theta_i^{t-1}}{4\alpha + r}, \qquad i = 1, 2, \dots, n, t = 1, 2, \dots, m \quad (11)$$

Thus, the total adaptation time of a team of distance learning course developers using cloud technologies is exactly the time during which a positive result is observed with the unchanged structure and personal composition of the team, by which we can unambiguously or with a given a priori accuracy identify the internal state of the team as a positive one. So, the total value of the adaptation time of the members of the team of distance learning course developers will first of all depend on the parameter to be observed and on which dimensionality the vector that describes the consolidated internal state of the development team acquires, as well as the properties of point-multiple reflections $\pi(*),\ p(*),\ \delta(*)$.

In the considered dynamic models, the rate of change of environmental states according to the time of adaptation of distance learning course development teams' members is such that the team "has time" to track the changes. However, and possible cases - in the conditions of fast-flowing changes of environmental states - when the development team will not be able to adapt. So, let us emphasize the assumption that each member of the distance learning course development team endows the opponent with the information flows it has at a given point in time.

Based on our research and mathematical models when considering the much more complex structures of awareness of team members of distance learning course developers, we believe that they will choose such actions that have information equilibrium [25, 34]. At the same time, situations with a complex structure of "observations" of team members are possible: some team members may observe some parameters, while other team members may observe other parameters.

Thus, if the dynamic adaptation of the developers of distance learning courses was considered as an adaptation to changes in the values of environmental states, and the very existence and habituation to them, and in fact depends on the information about these changes. Of course, in the general case, dynamic adaptation of some developers of distance learning courses involves not only changes in awareness and behavior, but also changes in the parameters of the system itself. In addition, we can also consider active adaptation, when the system purposefully affects the environment.

7. The model of the hierarchy of incentives for the needs of members of development teams

Let us analyze in detail the description of a formal model that analyzes the hierarchy of needs of any software development team member. Let there be *n* ordered needs, the first *k* of which are primary.

We will measure the degree (level) of satisfaction of *i-th* need by the number $x_i \in [0;1], i \in N = \{1, 2, \ldots, \mathrm{n}\}$ is a set of needs. Assume that the degree of satisfaction of the *i-th* need depends on the resource $u_i \geq 0$, focused on the satisfaction of this need, and on the levels of satisfaction of the needs of the lower levels:

$$x_1(u_1, u_2, \ldots, u_i) = min\left\{\mathrm{f}_i(u_i), \frac{min}{j = 1, i-1}\alpha_{ij}x_j\right\}, i \in N, \tag{12}$$

where $\mathrm{f}_i: \Re_+^1 \to [0;1]$ are known strictly monotone continuous functions, $\alpha_{ij} \in [0;1]$ are constants (weights) reflecting the relationship between needs, $j \leq i, i \in N$.

Since almost any individual specificity in needs can be accounted for by fitting the corresponding functions $\mathrm{f}_i(\cdot)$ and constant constants $\{\alpha_{ij}\}$, let us choose the degree of satisfaction of the highest of needs $s \in [0;1]$ as the aggregate satisfaction degree:

$$s(u) = x_n(u), where\ u = (u_1, u_2, \ldots, u_n) \in \Re_+^n \tag{13}$$

where $s(u)$ is a vector of resources.

Let us introduce a graph *(N, E)*, where the set of arcs *E* is a set of arcs from each vertex corresponding to the corresponding need to all vertex needs of higher level. Let us calculate the "potential" of the *i-th* vertex:

$$x_i^{max} = \frac{min}{j < i}\left(x_j^{max} \cdot \alpha_{ij}\right), i \in N \backslash \{1\}. \tag{14}$$

Expressions (12) and (13) allow one to find the degree of satisfaction of needs given functions $\mathrm{f}_i(\cdot)$ vector of resources *u*. It is also possible to solve the inverse problem of finding the minimum values of resources u^*, s^*, ensuring the achievement of a given level $s * \leq x_n^{max}$, where is the satisfaction of needs.

Let us denote by $\alpha = \left\|\alpha_{ij}\right\| i, j\ \in N$ the weight matrix (where α_{ij} is assumed to be one, $i \in N$, $f_i^{-1} i\ (\cdot)$ i $(\cdot)$ is the function inverse to the function $\mathrm{f}_i\ (\cdot), i \in N, l_{ij} = l_n\left(1 / \alpha_{ij}\right), L_i$, where is the length of the maximal path in the graph (N, E) from vertex *i* to vertex *n* under the condition that the level arc lengths $l_{ij}, i \in N$.

If the function $\mathrm{f}_i(\cdot)$ takes the value of s^* for the finite values of the resource, then the solution to this problem obviously looks like this:

$$u_i^*(s^*, \alpha) = \ f_i^{-1}(exp)(L_i)), i \in N. \tag{15}$$

So, the minimum values of resources to achieve a given level of $s * \leq x_n^{max}$ satisfaction of needs can be determined by the expression (15).

8. A dynamic model of team member incentives

Suppose that the primary needs are not saturated, $u_i(t) = q_i, i = \overline{1, k}$, and the secondary needs are such that they are saturated, that is $u_i(t) = q_i\, t, i = \overline{k+1, n}$. For a simple solution here and hereafter, we will assume that $\alpha_{ij} = 1, i \in N, j \leq i$. Then $L_i = 0, i \in N$, and we obtain these equations for the dynamics of measures of satisfaction of needs as a function of the vector $q = (q_1, q_2, \ldots, q_n)$ resources consumed per unit time:

$$x_i(q_1, q_2, \ldots, q_i, t) = \frac{min}{j = \overline{1, \iota}} = \mathrm{f}_j\left(q_j\right), i = \overline{1, k}, \tag{16}$$

$$x_i(q_1, q_2, \ldots, q_i, t) = min\left\{\frac{min}{j = \overline{1, k}} = \mathrm{f}_j\left(q_j\right), \frac{min}{m = \overline{k+1, \iota}}\mathrm{f}_m(q_m t)\right\}, \tag{17}$$

$$i = \overline{k+1, n.}$$

The resource vector must match the balanced constraint:

$$\sum_{i \in N} q_i \leq Q. \tag{18}$$

We obtain the necessary condition under which the level of satisfaction of needs s^* for a certain time is achieved. Consequently, to achieve the aggregate level of satisfaction of needs $s^* \leq x_n^{max}$ in a finite time it is enough to fulfill this condition:

$$\sum_{i=1}^{k} \mathfrak{f}_i^{-1}(s^*) < Q. \tag{19}$$

9. Effectiveness of models of motivation of team members

Let us now consider the problem on the speed of needs satisfaction, i.e. the minimization of time T to achieve a given level $s^* \in [0;\ 1]$ of needs satisfaction by distributing a certain resource according to its given constraints. We denote the minimal time (the result of solving the problem) by T^*.

From the proved statements follows the main idea, which is that all the secondary needs must reach the required level simultaneously. So, if $s^* \leq x_n^{max}$ and condition (19) is satisfied, then the solution of the problem on the speed of satisfying needs will look like this:

$$q_i = \mathfrak{f}_i^{-1}(s^*), i = \overline{1, k}, \tag{20}$$

$$q_m = \frac{\mathfrak{f}_m^{-1}(s^*)}{\sum_{l=k+1}^{n} \mathfrak{f}_l^{-1}(s^*)} \left(Q - \sum_{i=1}^{k} \mathfrak{f}_i^{-1}(s^*) \right), m = \overline{k+1, n}, \tag{21}$$

$$t^*(s^*, Q) = \frac{\sum_{l=k+1}^{n} \mathfrak{f}_l^{-1}(s^*)}{Q - \sum_{i=1}^{k} \mathfrak{f}_i^{-1}(s^*)}. \tag{22}$$

The obtained relations also make it possible to solve the problem of terminal control, i.e. minimization of allocated total resources to achieve certain results for a given time, to ensure the necessary degree of satisfaction of needs or maximization of the aggregate level of satisfaction of needs for a given time under fixed constraints on resources.

From mathematical expressions (20), (22) it is possible to obtain the dependence s^* *(t)*, describing (under optimal distribution of available resource) the dependence of needs satisfaction degree on time. For the case where $\forall i \in N\ \mathfrak{f}_i(\cdot) = \mathfrak{f}(\cdot)$, we obtain:

$$s^*(Q, t) = \mathfrak{f}\left(\frac{Q\,t}{n - k + kt}\right). \tag{23}$$

Size:

$$k(Q, t) = \frac{s^*(Q, t)}{Q \cdot t} \tag{24}$$

can be seen as the efficiency of using the available resources of the organization to meet the needs (motivation) of the members of the software systems development teams.

Assume that the function $\mathfrak{f}(\cdot)$ has a bounded derivative. Then, by substituting (23) into (24), calculating the time derivative, we thus obtain the following idea: over time, the efficiency of spending the available resources to motivate the members of software systems development teams decreases significantly.

Results of Research

The article considers the real scientific and applied problem of effective formation of teams of developers of distance learning courses, which is solved by taking into account the use of mathematical models of interaction to reduce the time interval of adaptation of each of the team members. And quickly find the role during the development of distance learning courses, and this approach provides the achievement of maximum interaction in the team when performing assigned tasks.

Conducting detailed research on the use of group dynamics methods, namely, the interaction of team members on the efficiency of training distance courses, we have developed and offered a methodology for the formation of developers teams using mathematical models of their members and taking into account professional competencies. These mathematical models were offered to universities and firms that specialize in the development of training distance courses, as well as providing a balanced team to reduce the time interval and adapting each of the members. Thus, providing quick adaptation to the distribution of roles in the development of distance courses, thereby creating a positive microclimate, and financial resources are maximally optimized. Analytical detailed research and experiment confirmed our hypothesis about the feasibility of using mathematical models of interaction between elements of the developers of training distance courses in the team building, which ensured an increase in the efficiency of the designated tasks by 17.27%. Therefore, it can be assumed that approximately 15% of the time of the team and their members were used to coordinate their positions and places in the team at the beginning of the task of developing training distance courses.

Conclusion

From the point of view of the theory of research of dynamic mathematical models, it should be recognized that the various results of research obtained in psychology and sociology on the coordination of groups of developers of distance courses, obtained in psychology and sociology, describing formal models today, are not fully reflected by scientists. In the case of many dynamic models, there are some difficulties in obtaining analytical solutions. For example, so common in practice, the class of problems on the formation and existence of teams, taking into account the psychotypes of each team member in sports teams or teams of developers of information and communication systems is not yet the subject of deep theoretical and systemic research. We believe that a promising direction is to expand the categories of educational tasks using dynamic mathematical models for further application in research. This model uses real mathematical models to describe the process of coexistence of real organizations and team members and consider their psychological types. Development and use. It should be noted that the main equipment used to study the mechanism of innovative approach to the development of distance courses, developed by the management company for the communication system and its staff, is a dynamic mathematical modeling. On the one hand, the use of dynamic mathematical models allows you to make reasonable conclusions and establish a quantitative relationship between the main phenomena and internal processes. On the other hand, it should be remembered that in the construction of any dynamic mathematical model will be introduced many logical contradictions.

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