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Organization of Personnel Training in Universities of Uzbekistan using the Methods of Scheduling and Network Planning in Conditions of Self-Isolation

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Abstract
The need to maintain the rhythm of the educational process in the face of pandemics and other force majeure circumstances, to increase student satisfaction with distance education and their motivation for independent work determine the relevance of the introduction of available methods of structuring, ordering, visualization and optimization of the educational trajectory of mastering the discipline. The purpose of this study is to introduce scheduling and network planning in training personnel in self-isolation. The possibility of presenting the personnel training process as a project with an interconnected set of works and control events, for the management of which it is advisable to use RM tools, is theoretically substantiated. A conceptual model of a calendar-network plan for mastering the LS discipline based on the work program of the LS discipline of the Tashkent State Technical University is presented. A network of control events has been developed that visualizes the composition and procedure for completing intermediate tasks in the discipline for its successful mastering. The proposed methods for managing the content and schedule of a training project can be used to build individual learning paths.
Keywords: organization of distance learning, self-isolation, satisfaction with learning, project management, scheduling and network planning, content and schedule management, student motivation, life safety.
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1. Introduction

The rapid spread of COVID-19 on a global scale in the spring of 2020 and the introduction of a long-term forced self-isolation regime required an urgent transformation of the educational process from educational institutions in many countries. The traditional contact method of training personnel within the framework of classroom studies has been replaced by distance learning using digital technologies. Similar transformations in the training process took place in the universities of Uzbekistan in connection with the introduction of self-isolation on March 16, 2020, and the transition to remote interaction between teachers and students. Naturally, the initial period of the introduction of new forms of interaction between teachers and students was accompanied by a violation of the rhythm of the educational process, deviations in the content and schedule of academic disciplines, a variety of used options for electronic resources, digital platforms, messaging programs, etc.

It is known that resistance to innovations, the development of negative emotions and experiences, affects the cognitive assessment of changes and satisfaction with them (Rasskazova E., Lebedeva A. 2020). So, during the period of the beginning of the forced transition to distance learning, the following were registered: an increase in the duration of screen time for both students and teachers; increased loads on the visual analyzer, musculoskeletal and nervous systems, which together negatively affect the state of health (Milushkina O.Yu. et al. 2020; Dozhdikov A.V. 2021; Frolova E.V. et al. 2020).

At the same time, it was found that self-organization, without which effective distance learning is impossible, is formed in the process of adaptation of students to innovations, the speed of which depends on the awareness of options for individual educational routes, due to the structural decomposition of the complex content of disciplines (Smirnov E.I. et al. 2020). It was revealed that the traditional contact format of training allows organizing the effective classroom and independent work of students if the volumes and workload of students are agreed upon (Tikhonova O.V. et al. 2019).

In addition, the need to preserve the quality of the educational process in conditions of force majeure requires the teacher to develop a set and sequence of intermediate control points with a modular discipline structure, in the form of a fund of assessment tools, focused on the final result of the student's mastering of the subject (Sakharchuk E.I., Baykina E.A. 2020; Strenacikova, M. Jr., Strenacikova, M. Sr. 2020). Indeed, the assessment of learning outcomes remains one of the problems of online education and affects the motivation and success of students mastering the discipline (Klimenskikh M.V. et al. 2019).

The introduction of digital pedagogy requires a new architectonics of education, technologization and algorithmization of educational processes (Ilaltdinova E.Yu. et al. 2019). which is consistent with the general development trends of Industry 4.0, which involves the introduction of digital technologies in various spheres of

an individual's life. In particular, it is shown that model schemes for mastering disciplines allow a student to choose the architecture of his educational trajectory (Ovinova L. N., Shraiber E.G. 2019), which will ensure an increase in the quality of education and the quality of life (Sazonov B.A. 2020; Serditova N.E., Belotserkovsky A.V. 2020).

On the part of the teacher, the digitalization of education requires the formalization of knowledge and their presentation using graphic language, visualization of the trajectory of mastering disciplines (Makulin A.V., Korzina M.I. 2020). At the same time, one should take into account the high level of digital illiteracy, especially among the older generation of teachers, as well as lower digital literacy in regional universities relative to those in the capital (Baskakova M., Soboleva I. 2019). On the part of students, digital resources are also used mainly for quick search, generalization, transfer of information, while the use of information technologies to increase the efficiency and effectiveness of independent learning is insufficient (Vasileva L.N. et al. 2020).

Accordingly, the problems of maintaining the rhythm of the educational process in the context of pandemics and other force majeure circumstances, increasing student satisfaction with remote education and their motivation for independent work, determine the relevance of the introduction of available methods of structuring, ordering, visualization and optimization of the educational trajectory of mastering the discipline, in the context of trends in algorithmic processes. within Industry 4.0, on the one hand, and the lack of specific digital teacher training, on the other.

Remote interaction of a teacher with a group of students within the framework of teaching a discipline has a specific goal, measurable indicators and a time frame for mastering the subject, which makes it possible to draw an analogy with remotely working project teams of employees (Deddy R., Tobing H. 2015).. Publications on working with remote teams prove the advisability of dividing a set of works into separate tasks (Kazai G et al. 2012), compiling a sequence of microtasks (Mason W., Suri S. 2011; Thaler S. et al. 2012), well structured and understandable by performers (Franzoni C., Sauermann H. 2014; Barbier G. et al. 2012).

Accordingly, the work of a teacher with students can be considered as interaction with a remote team to implement a project of mastering the discipline, while the Project Management[1] (PM) methodology involves the use of specific tools for structuring the content and schedule of the project for its effective implementation (Chatfield A.T. et al. 2014; Derbe G. et al. 2020; Neborsky, E.V. et al. 2020).

The purpose of this study is to introduce scheduling and network planning in training personnel in conditions of self-isolation and distance learning and to establish the effectiveness of its application.

2. Methodology

The research materials were publications in leading scientific journals on organizing interaction with remote teams on the principles of PM (authors Deddy R., Tobing H.; Kazai G, Kamps J., Milic-Frayling N.; Mason W., Suri S.; Thaler S., Simperl E., Wölger S.; Franzoni C., Sauermann H.; Barbier G., Zafarani R.H., Gao G., Liu H. and others).

The use of general theoretical methods - analysis, comparison and analogies made it possible to establish the possibility of applying PM tools to the organization of a distance educational process when mastering a specific discipline. The issues of structuring, scheduling and visualization of the project progress (Barbier G. et al. 2012; Chatfield A.T. et al. 2014; Derbe G. et al. 2020), in particular, in conditions of uncertainty (Abou-Ibrahim H. et al. 2019; Al-Nasseri H., Aulin R. 2016; Al-Nasseri H., Aulin R. 2015; Bakry I. et al. 2016) are described in the works of Abou-Ibrahim H., Hamzeh F., Zankoul E., MunchLindhard S., Rizk, L.; Al-Nasseri H, Aulin R; Bakry I., Moselhi O., Zayed T. et al. PM tools are used primarily in construction projects.

A detailed review of publications in terms of project activities in the field of education and the effect of the implementation of specific projects within individual disciplines is given in the work of Kalinin S.I. (Kalinin S.I., Toropova S.I. 2020). However, no publications are presenting the process of mastering the discipline as a project, as well as applying PM tools to educational activities.

A theoretical study close to the topic of this article is the work of K.M. Badau, where PM tools are recommended to structure the educational process to self-organize students and build a learning trajectory: network analysis technique; program valuation and review techniques; critical path method; and many others (Badau K.M. 2017). However, the results of their practical implementation in the process of mastering any discipline by a student are not presented.

The study was conducted based on the Tashkent State Technical University (Tashkent, Uzbekistan) in the course of teaching the discipline “LifeSafety” (LS) in the spring semester of 2020 from the moment of the announcement of the self-isolation regime until the end of the semester. The method of modelling the educational trajectory of mastering the LS discipline with subsequent calendar-network planning of the content and schedule of the subject was used.

The leading research method was a pedagogical experiment. The experiment involved five groups of

[1]PMBOK® Guide and Standards. Project Management Institute URL: https://www.pmi.org/pmbok-guide-standards

students (2nd year, 4th semester) of various fields of study, 125 people in total. Unlike the traditional experiment with the experimental and control groups of students, in particular, for the same number of students in the context of the COVID-19 pandemic and the self-isolation regime, mastering the LS discipline using a calendar-network plan was experimental, and the rest of the disciplines in the same period - control. Satisfaction with the organization of distance learning and the motivation of students to independently master the disciplines remotely was assessed using a questionnaire method.

3. Distance learning

The field of higher education can be safely called one of those that the pandemic has had the greatest impact on a global scale. Thus, the global development of the COVID-19 pandemic has led to an unprecedented situation with the pedagogical continuity of the educational process, when educational institutions, in particular, institutes and universities, in the shortest possible time were reoriented from the traditional familiar full-time form to the distance one. And although the educational activity is multifaceted, it is based on different sources and factors, we are talking not only about educational continuity, but also pedagogical. The coronavirus pandemic triggered a global paradigm shift for the entire education system towards online learning, and the crisis still acts as a catalyst that accelerated the development of online education.

In the initial period of the introduction of the self-isolation regime in the universities of Uzbekistan, which traditionally carried out contact training of personnel, there was no single system for organizing remote training in disciplines that previously involved classroom training.

Distance learning, of course, provides an opportunity to facilitate the possibility of obtaining education, expanding its boundaries; allows you to adapt curricula and independently determine the training schedule; provides accessibility and mobility. Today, the development of distance education at the present stage is defined as an important landmark of state policy in the field of education. In the emergency conditions of the transition to contactless learning, teachers could use digital resources Moodle, YouTube, Zoom, Skype, etc. for delivering lectures and monitoring learning outcomes. To notify about the schedule and resource for placing lectures and assignments, SMS, E-mail, WhatsApp messages were used through the group leaders.

The variety of digital resources used in various subjects, deviations in the schedule and content of training, disruptions in communication processes, increased workloads on the teacher, headmen and students impeded the effective organization of the educational process. At the same time, it should be noted that in the universities of Uzbekistan, work programs in disciplines, including a thematic lesson plan with hours of classroom and independent work on each topic, are not available to students. In such conditions, a remotely studying group of students is in conditions of uncertainty and the risk of missing a lesson/task.

4. Assessment of satisfaction with online education

Satisfaction with online education and the motivation of students to study in self-isolation was assessed at the end of March 2020 during a remote express questionnaire following the results of two weeks of training in a new format (primary survey). The repeated questioning was carried out according to the results of the pedagogical experiment at the end of April of the same year. During the second questioning, the students were asked to fill in the questionnaire twice with identical content: (1) according to the results of the implementation of the calendar-network plan for mastering the LS discipline (experiment); (2) on the educational process as a whole, except the discipline LS (control). The questions of the availability of home computer equipment, home Internet and the quality of Internet connection were not considered in this study.

The statements of the questionnaire drawn up using Likertscale and the results of processing the answers are presented in Table 1. In the table, the numerical values correspond to the answers: -2 - absolutely disagree; -1 - partially disagree; 0 - find it difficult to answer; 1 - partially agree; 2 - completely agree. Table 1 contains only those answers (points) that were noted by the largest number of respondents. The statements in the questionnaire are sorted from private to general. Thus, statements 1-7 reflect the problems of organizing the educational process and affect the satisfaction of students with the organization of distance learning (statement 8), as well as the motivation for independent mastering of the discipline (statement 9). Accordingly, statements 8 and 9 are control statements.

It should be noted that the establishment of a correlation between the answers to statements 1-7 and 8, as well as 1-7 and 9 and a set of other statistical results of data processing are not the purpose of this study and will be presented in a separate publication.

Table 1. Results of questioning students on satisfaction with distance learning (obtained by the author)

Approval	PrimarysurveyMarch 2020.	Re-examination, April 2020.	
		The experiment	Control
1. The class schedule is known and consistent at least one week in advance	-1 (65%)	2 (100%)	2 (78%)
2. Digital resources for classes are known and unchanged at least one week in advance	-2 (48%)	2 (100%)	2 (86%)
3. Checkpoints (tasks) are known and unchanged at least one week before they are due	-2 (53%)	2 (100%)	1 (83%)
4. Online classes do not coincide in time with other disciplines (no "overlap" in the schedule)	-1 (56%)	2 (100%)	1 (100%)
5. The schedule is known and unchanged until the end of the semester	-2 (75%)	2 (100%)	0 (69%)
6. Class topics are known and remain unchanged until the end of the semester	-2 (83%)	2 (100%)	0 (53%)
7. The set of test points (assignments) is known and unchanged until the end of the semester	-2 (89%)	2 (100%)	0 (46%)
8. I am satisfied with the organization of remote learning	-2 (78%)	2 (86%)	1 (52%)
9. The organization of training allows you to independently plan the course of study of disciplines	-2 (92%)	2 (92%)	-1 (38%)

The results of the initial survey, two weeks after the transition to distance learning, are characteristic of a situation of uncertainty in which teachers and students found themselves in self-isolation. Most of the respondents “partially disagree” with the stability of the schedule even within a week and the absence of “overlaps” and “completely disagree” with the statements about the invariability of the set of digital resources, checkpoints; about awareness of the content and schedule of disciplines until the end of the semester. Violation of the rhythm of the educational process concerning traditional contact training and the absence of a training trajectory for short and long term periods led to general dissatisfaction with the organization of distance learning and the impossibility of independent planning of the order of mastering disciplines.

Answers to statements 1-7 (table 1) during the initial survey made it possible to establish the expediency of streamlining, structuring and visualizing the process of mastering the discipline; control statements (8, 9) showed the need to present students with the course of the educational process for a long-term period. In this regard, a conceptual model of a calendar-network plan (by analogy with Gantt Diagram) (Figure 1) and a network of control events (Figure 2) have been developed based on the thematic plan of the work program for the LS discipline.

In general, according to the PM methodology, scheduling and network plans reflect processes (in this case, lectures, practices, independent work) and/or control events (in this case, tasks), the sequence (chain) of which leads to the final result (in this case, mastering discipline LS). The set of PM tools and methods is systematized in the work of Martinelli R.J., Milosevic D.Z.[1] ...

For tabular or graphical visualization of plans, there are special software products, for example, Project Expert, however, in conditions of insufficient digital training of teachers, it is possible to use Word, Excel, Paint, Visio, etc.

[1]Martinelli, R.J. Project Management ToolBox (2nd Edition) / R.J. Martinelli, D.Z. Milosevic. – Wiley, 2016. – 460 p.

Weeks	Topics (Lectures in Moodle)	Chekpoints (tasks in Moodle)	
1	Module 1. Theoretical foundations of LS. Topic 1. Concepts of LS	essay	
2	Topic 2. Legal basis of LS	summary	
3	Topic 3. Operational safety	report	
4	Topic 4: Ergonomics and Psychology of LS	rewiew	Quiz M.1
5	Module 2. Industrial safety management. Topic 5. Industrial safety	essay	
6	Topic 6. Training of employees in industrial safety	summary	
7	Topic 7. Accidents and occupational diseases	report	
8	Topic 8. Sanitation and hygiene of production	essay	
9	Topic 9: Exposure to dust and toxins, protection from them in production	summary	
10	Topic 10. Ventilation and lighting	calculation	
11	Topic 11. Noise and vibration	calculation	
12	Topic 12. Radiation	calculation	
13	Topic 13. Electrical safety	calculation	Quiz M.2
14	Module 3. Emergencies and Civil Protection. Topic 14.Emergency	essay	
15	Topic 15. Civil protection	summary	
16	Topic 16. Earthquakes	report	Quiz M.3
17	Module 4. Topic 17. Fire safety	Quiz M.4	
18	Module 5. Topic 18. Primary health care	Quiz M.5	Total Quiz

Figure 1. Conceptual model of the calendar-network plan for mastering the LS discipline (developed by the author)

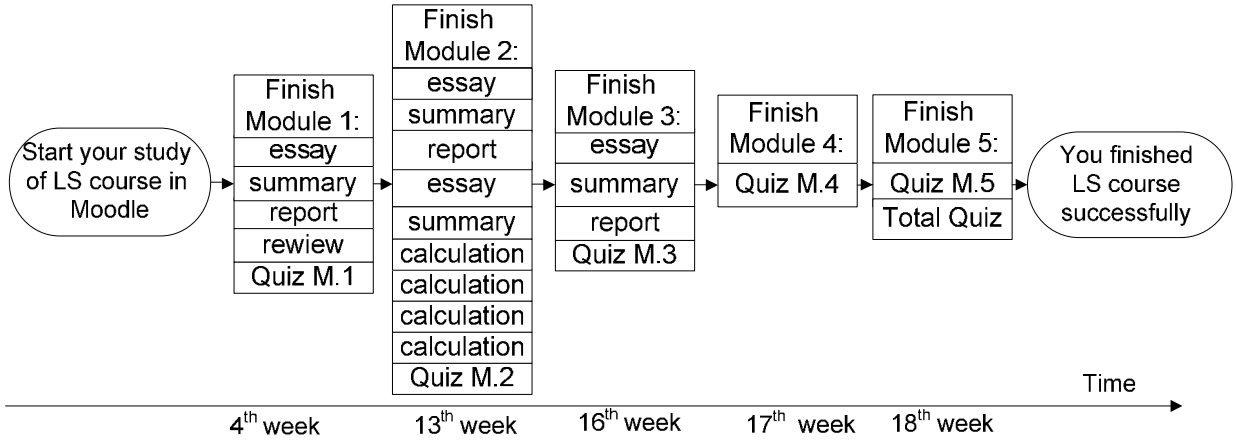

Figure 2. Network of control events of mastering the LS discipline (developed by the author)

The pedagogical experiment consisted of the development and provision of students of five groups, 2 courses studying LS in the spring semester of 2020 with calendar-network plans according to Figures 1 and 2. Experimental development was not introduced into the process of mastering other disciplines. Moodle was chosen as the main platform for interaction "teacher-student". As a result, during the second survey (one month after the initial survey), it was revealed:

(1) in the LS discipline (experiment): the popularity and invariability of the subject matter, the schedule of classes/assignments, digital resources, both in the short-term and in the long-term, were noted (statements 1-7, table 1); high satisfaction with distance learning and readiness for independent planning of the way of mastering the subject was registered (statements 8, 9, table 1).

(2) for the rest of the semester (control): there was an increase in the orderliness of the educational process in the short term (statements 1-3, table 1); the uncertainty of long-term planning is established (statements 5-7, table 1), which does not allow you to independently choose the learning path (statement 9, table 1); the growth of loyalty to distance learning is shown (statement 8, table 1), which, in addition to increasing the efficiency of its organization, can also be due to the general adaptation of students to changes.

Figure 3 shows the percentage distribution of responses to statement 8, across all Likert scale items. This allows us to demonstrate the change in student satisfaction with distance learning: from a sharply negative attitude during a force majeure transition to distance learning during the initial survey to a more positive attitude in the context of student adaptation over time by increasing the effectiveness of the organization of distance learning as a whole. As a result of the experiment on the implementation of calendar-network schedules of the LS discipline, a significant increase in satisfaction was established, due to the solution of the problems reflected

in statements 1-7, table 1.

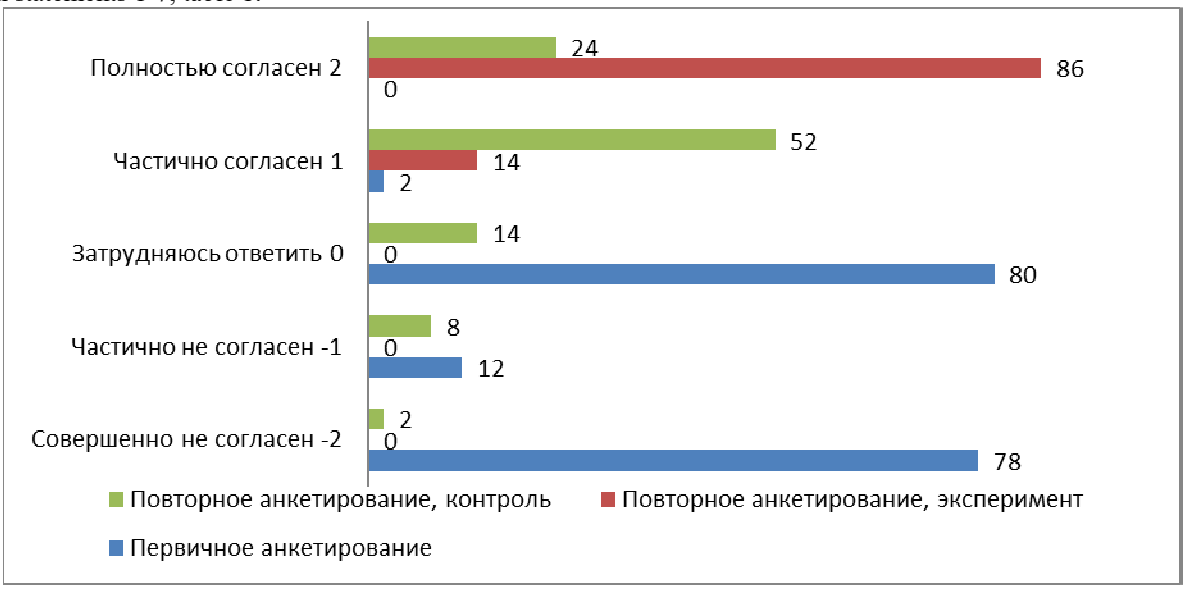

Figure 3. Student satisfaction with the organization of distance learning, in% of responses to Likertscale statements, table 1 (obtained by the author)

It should be noted that the Moodle platform room, which houses all lectures and specific tasks/tests, according to Figure 1, should be completed for the entire semester and, if necessary, be updated in advance, before the start of the next semester, so that students have a long-term idea of learning paths. Even with the restoration of traditional classroom training, in the face of the threat of the spread of COVID-19, it is impossible to completely exclude a return to self-isolation.

In addition, providing students with a model scheme for mastering an educational discipline (Figure 1) and a network diagram with the presentation of control points for individual modules of the discipline (Figure 2), when developing them for each subject of the curriculum and subject to the full advance filling of Moodle classrooms, will allow the student to, for those who find themselves on distance learning due to personal force majeure circumstances, build an individual trajectory for mastering the discipline with an emphasis on mandatory checkpoints. The function of building individual educational trajectories for students studying remotely can also be undertaken by deans.

5. Conclusion.

The author's contribution lies in the theoretical substantiation of the possibilities of using project management tools; surveying students; setting up and conducting a pedagogical experiment; developing a scheduling network plan and a network of control events in the LS discipline.

The possibility of presenting the personnel training process as a project with an interconnected set of works and control events, for the management of which it is advisable to use RM tools, is theoretically substantiated. A conceptual model of a calendar-network plan for mastering the LS discipline based on the work program of the Tashkent State Technical University is presented. A network of control events has been developed that visualizes the composition and procedure for completing intermediate tasks in the discipline for its successful mastering.

A pedagogical experiment of introducing calendar-network models in the course of teaching the LS subject was conducted. As a result of the questioning of students, an increase in their satisfaction with distance learning and an increase in motivation for independent mastering of the discipline as a result of the experiment were registered. The scientific and practical results of the study are aimed at maintaining the rhythm of the educational process in conditions of emergencies, pandemics, individual force majeure circumstances.

Project management tools, in particular, calendar-network diagrams, similar to GanttDiagram can be recommended for inclusion in the work programs for the discipline and application to optimize the educational process. It is recommended that the teacher fill the Moodle classrooms with lectures/assignments on time and provide students with calendar-network models of the course of mastering the discipline, indicating checkpoints for each module of the discipline, which will allow students/dean's offices to plan individual trajectories of mastering the discipline when circumstances arise for the student to switch to remote learning.

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