Digital transformation of educational process planning at a university

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***Abstract*—The article discusses the innovative process of preparing curricula within enlarged groups of specialties (areas of training) with the integration of general disciplines into a stream. This method provides a reduction in the total load, as well as simplification of the automation processes for the preparation of the curriculum.**

Keywords—educational process, optimization, training direction, curriculum, discipline

I. INTRODUCTION

The modern educational process in most universities is characterised by a significant set of specialities, areas of training, and profiles of areas of training for future graduates. This can be explained by the diversity of desires of applicants and their parents in choosing a future profession, as well as the need of the national economy for a wide range of highly specialised graduates. Therefore, in almost every university there is a need for a significant number of groups of up to 15 students. Since the curriculum is compiled separately for each speciality, field of study or profile of training, then in the whole university this leads to a significant increase in the study load.

On the 15th January 2020, President of Russia V.V. Putin gave the Address to the Federal Assembly, wherein he set the task "to enable second-year students to choose a new direction or study programme, including related professions" [6].

One of the solutions to this problem for enlarged groups of training areas may be the digital organisation of the educational process proposed by the authors, which ensures the integration of small groups into streams in the first two courses.

II. FORMULATION OF THE PROBLEM

The problem of increasing the workload is observed not only separately in each area of training, but also within the enlarged groups of areas of training. A large number of small groups of students for whom one has to give lectures and conduct practical exercises in all subjects of the curriculum throughout the learning process leads to low profitability of the university as a whole. In this context, the task arises of optimising the costs of implementing educational programmes and organising the educational process at a university.

The existing problem of small groups and small flows that reduce the cost-effectiveness of training students, both with budget funding and with paid tuition, prompt universities to look for alternative ways to solve it. Attempts to reduce the diversity of specialities, areas or profiles of student training lead to a decrease in the attractiveness of the university in the eyes of applicants and their parents, nor does alternating the recruitment of applicants for different areas of training by year have the desired effect.

III. SOLUTION DESCRIPTION

According to the authors, one alternative that has a significant prospect for solving the existing problem of small groups (streams), is to change the organisation of the educational process for those enlarged groups of specialities, where all specialities, areas of training and training profiles combined into enlarged groups are concentrated in one faculty (institute) of a specific university.

In this context, taking into account the opportunities provided by the higher education institutions of the last generation, the authors propose changing the process of developing curricula for preparing students within large groups of specialities, where possible. Of course, in each case, the decision on the possibility of using the proposed method remains with the developers of the curriculum.

The authors' experience in the period from 1998 to the present shows that the proposed change in the organisation of the educational process is quite possible.

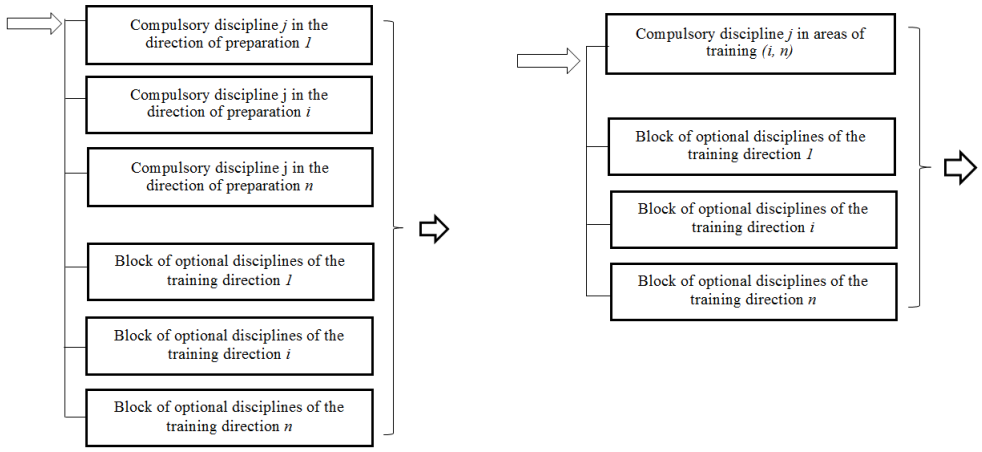
As an illustration, to consider the proposed changes, we consider the block diagrams of the generally accepted curriculum development for an enlarged group and that proposed by the authors (Fig. 1).

For each enlarged group of specialities/areas of training, you can draw up curricula that will differ only in the disciplines of the main cycle necessary for this speciality (field of study or profile of training).

For example, for the specialities "Publishing and Editing" and "Book Distribution", you can teach the disciplines of auxiliary cycles in one stream and for separate students only when studying disciplines of the main cycle.

To test the proposed curriculum compilation scheme, the authors developed standard curricula in the form of network graphs for the specialities of "Publishing and Editing" and "Book Distribution", which provide for the passage of all general educational disciplines for all students of this enlarged group of specialities in one stream. The division of students into groups occurs only when studying special disciplines, and thus, a significant reduction in the total load in an enlarged group of specialities is achieved. An illustration of integrative graphs of professional competence is presented in Fig. 2.

An analysis of the curricula developed in the form of network graphs shows that, in this case, not only is a reduction in the overall load achieved, but there is also the possibility of significantly simplifying the automation processes for scheduling semesters.



A B

Fig. 1. Curriculum development schemes (A – generally accepted; B – proposed).

The graphs of the educational process are developed for the entire period of study and are directed from one semester to another, which makes it possible to create time-oriented procedures for scheduling for a semester, academic year, and even for the entire training period.

The graphs not only take into account the actual process of conducting classes but also allow you to determine the time (start and end of work) for the timely preparation of the necessary teaching materials for a quality training process, starting from work programmes, term papers, practical and laboratory work and documentation for them, practices, and the preparation and protection of final qualifying work.

IV. Experimental Research

From the illustration of the network graphs of the curricula of the specialties “Publishing and Editing” and “Book Distribution” belonging to one enlarged group, it can be seen that in the first semester of the 7 disciplines taught in this enlarged group, in six disciplines, students can be combined into one flow, in the second semester - 6, in the third - 8, etc. These data are shown in table 1.

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An analysis of the Federal State Educational Standards of Higher Education (3 ++) in the areas of undergraduate “Media and Information and Library Science” [8] shows that in all areas of training included in this group (Publishing, Journalism, Television, Media Communications, Advertising and public relations) the educational programme should ensure the implementation of disciplines included in the compulsory part of the programme with load volumes of the same or similar magnitude. These disciplines include philosophy, history (Russian history, general history) and life safety (compulsory disciplines).

Having examined the plans existing for 2019-2020 at Samara University, we see that in the compulsory disciplines “Philosophy” and “History (Russian history, general history)” the number of hours provided for the study of these disciplines coincides and equals 108 hours (Table 2) Consequently, we can safely talk about combining these disciplines into a stream and reading each of them in one stream.

In the discipline “Life Safety” the number of hours for this discipline does not coincide in all areas of training. To be able to teach this discipline also in one thread, it is necessary to equalise the number of hours for this discipline.

Table I. The number of supporting disciplines that can be combined into one stream

Semester	**The total number of disciplines per semester for various specialties of one enlarged group of specialties**		**The number of disciplines that can be combined into a stream**
	Publishing and Editing	***Book distribution***	
I	7	7	6
II	8	7	6
III	9	9	8
IV	11	11	9
V	10	8	7
VI	9	9	4
VII	8	6	3
VII	8	7	1
IX	7	6	0

Table II. The number of hours provided for the study of disciplines of the compulsory part of the undergraduate programs “Mass Media and Information and Library Science” in various areas of preparation

Subject	**Direction of preparation**	**The number of hours provided for the study of the discipline**
Philosophy	TV	108
	Journalism	108
	Publishing	108
	Advertising and public relations	108
History (history of Russia, general history)	TV	108
	Journalism	108
	Publishing	108
	Advertising and public relations	108
Life safety	TV	72
	Journalism	72
	Publishing	108
	Advertising and public relations	72


Integrative graph of professional competence
specialty 030901 “Publishing and editing”
1st year student
2nd year student
3 year student
4th year student
5 year student
I
II
III
IV
V
VI
VII
VIII
IX
X
Graduation project
physical culture
foreign language
national history
cultural science
philosophy
political science
sociology
psychology and sociology of reading
jurisprudence
legal basis of book business
copyright
history of domestic literature
history of foreign literature
modern literary process
theory literature
textology
modern russian language
practical and functional style Russian language
workshop spelling
journalism
active processes in modern in Russian language
text theory
history book business
editing. General course
bibliography
bibliology
book standards
scientific and technical information
technology publishing the process
fundamentals of production processes
advanced course foreign language Machine translation
artistically technical design of printed matter
editorial preparation editions
modern domestic and foreign publishing
mathematics and computer science
information technology in book publishing
computer graphics in book business
information processing software
life safety
technology development automated information systems
electronic publications
source study and historiography
natural science
economics
features of the Russian economy
book marketing
advertising the activity publishing houses
business ethics communication
book management
control modern publishing the process
book business
personnel manageme
economics and organization publishing the activities
book marketing in publishing house
publishing planning
book distribution technology
organization management international the activities in publishing business
28/813
29/803
30/905
31/943
30/838
27/799
26/875
24/896
23/930
Legend:
Department of Publishing and Book Distribution
Department of Printing Technology
Department of Foreign Languages
Department of Philosophy
Department of Physical Education
Department of Informatics
Department of Flight Dynamics
Department of Political Science and History
exam
offset
transition from semester to semester
course project

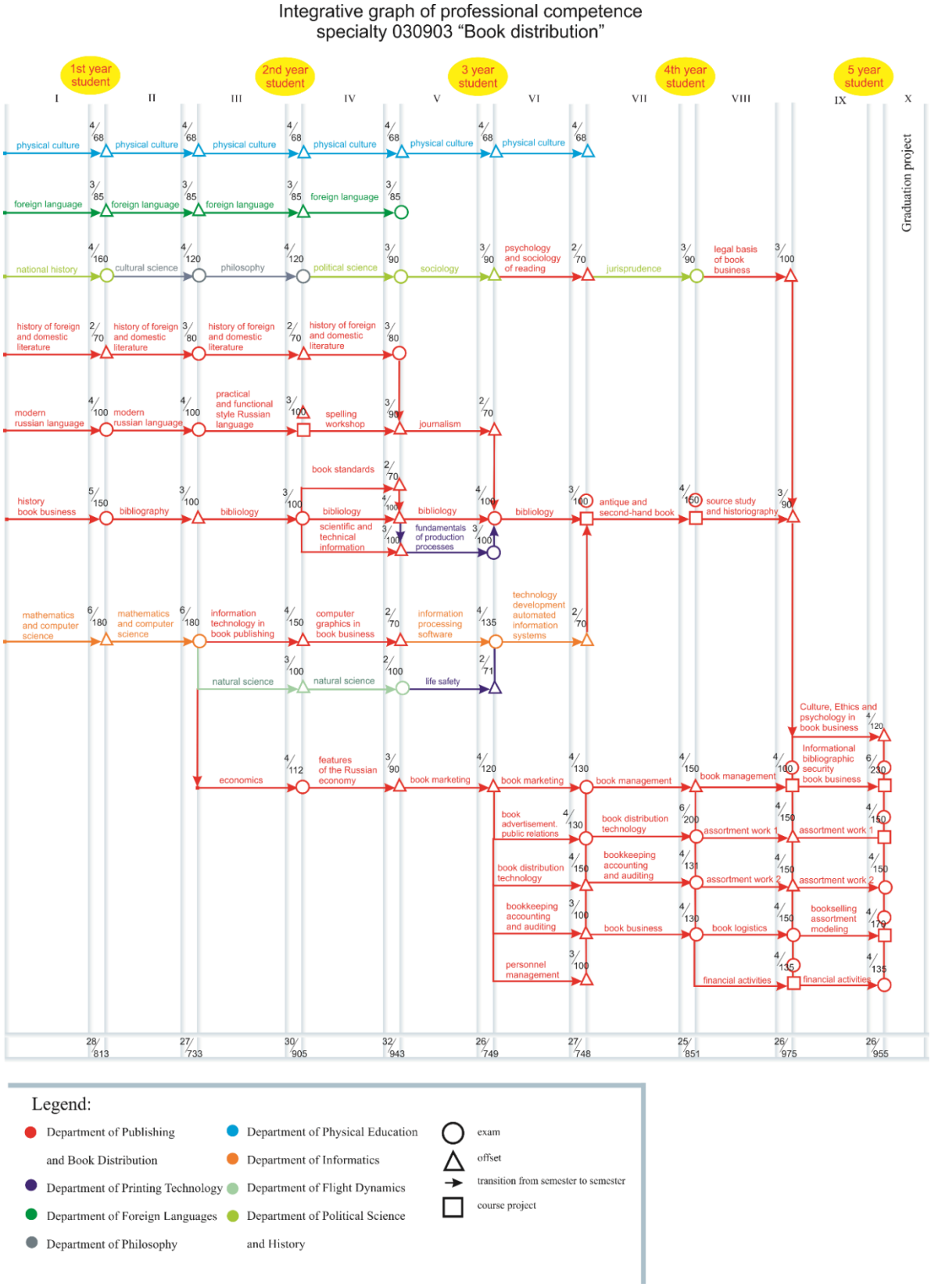

Fig. 2. Illustration of network graphs curriculum specialties one enlarged group.

The same can be done for disciplines that are compulsory in these areas of training and are included in the block of compulsory disciplines, for example, the disciplines “Modern Russian Language” and “Russian Language in Professional Activities” (Table 3).

For this, the authors propose the following algorithm (Fig.3).

Let there be i main directions of training i ϵ (1, n) with j ϵ (1, m) identical disciplines. To draw up a digitalised curriculum for the entire course of study, we divide the work by year and for each academic year, we teg all academic disciplines with an indication of their volume (load) by year of study.

TABLE II. THE NUMBER OF HOURS PROVIDED FOR THE STUDY OF DISCIPLINES OF THE COMPULSORY PART OF THE UNDERGRADUATE PROGRAMS "MASS MEDIA AND INFORMATION AND LIBRARY SCIENCE" IN VARIOUS AREAS OF PREPARATION

Subject	Direction of preparation	The number of hours provided for the study of the discipline
Philosophy	TV	108
	Journalism	108
	Publishing	108
	Advertising and public relations	108
History (history of Russia, general history)	TV	108
	Journalism	108
	Publishing	108
	Advertising and public relations	108
Life safety	TV	72
	Journalism	72
	Publishing	108
	Advertising and public relations	72

TABLE III. THE NUMBER OF HOURS PROVIDED FOR THE STUDY OF THE DISCIPLINES "MODERN RUSSIAN LANGUAGE" AND "RUSSIAN LANGUAGE IN PROFESSIONAL ACTIVITIES" OF THE COMPULSORY PART OF THE UNDERGRADUATE PROGRAMS "MEDIA AND INFORMATION AND LIBRARIES" IN VARIOUS AREAS OF PREPARATION

Subject	Direction of preparation	The number of hours provided for the study of the discipline
Modern Russian language	TV	180
	Journalism	180
	Publishing	216
	Advertising and public relations	0
Russian language in professional activities	TV	72
	Journalism	72
	Publishing	0
	Advertising and public relations	72

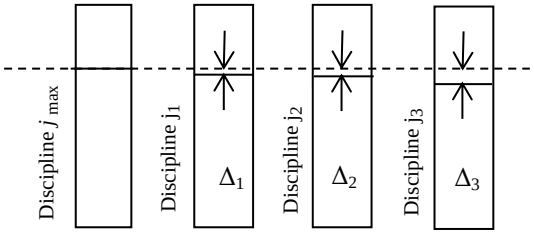

Fig. 3. Algorithm for load balancing in compulsory disciplines of preparation areas of an enlarged group.

Next for each school year:

1. Choose the j-th discipline the same for all i-th areas of training.

2. We have the i-th direction of training as the hours of load in the selected j-th discipline increase.

3. We determine the i-th direction of training with the selected j-th discipline having the maximum load S_{ijmax}.

4. We determine the difference in loads for the selected j-th discipline in the listed i areas of training:

$$S_{ijmax} - S_{ij} = \Delta_{ij}$$

5. Equalise the load of each ij-th discipline by the value of its difference Δij to the value of Sijmax by reducing the load of optional disciplines of the same curriculum.

6. We approve the received volumes of loads on the recalculated mandatory j-th disciplines of each i-th direction of preparation of this enlarged group.

7. We approve the received loads of optional disciplines of this enlarged group

V. CONCLUSION

The modern labour market is changing dynamically, presenting more and more challenges to higher education. New professions are constantly appearing and requirements for existing ones are becoming more complicated; therefore, higher education must respond flexibly and quickly to these questions.

The authors proposed a way to digitalise the educational process; in particular, computer optimisation of curricula in all areas of preparation of an enlarged group provides students with basic training for two years for them to choose the actual course of study from the third year. Digitalisation will simplify the development and release of semester curricula for students and teachers, and offer it online on demand.

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