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# IMPROVING THE QUALITY OF EDUCATION MANAGEMENT WITH BIG DATA PROCESSING TECHNOLOGY

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### *Abstract*

In modern educational institution management systems, big data technologies are almost never used, although the interest for this kind of information and its processing is highly relevant today. The use of big data technologies in other areas gives a qualitative increase in the efficiency of systems, for example: medicine, economics, banking, city administration systems, etc. The examples of successful applications of big data technologies in student assistance systems at universities show that the use of big data technologies in the field of education will improve the process of managing education in educational institutions. As an example, the authors consider methods of scheduling using automated school scheduling systems. The systems for scheduling are created, however they may not include all information about the organization and management of educational process in a school or university. However, without the use of big data technologies, it is impossible to take into account all the special cases in each particular school, which complicates the learning process and the process of its managing.

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**Keywords:** Big data, education, school timetable.



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## **1. Introduction**

One of the challenges of using big data is to draw up a school timetable. Currently, this problem is being solved manually or with the help of automated school curriculum systems. These systems allow to manually enter all the necessary data about the educational institution, such as: the number of academic subjects, the number of students, available classrooms, etc., and after entering data, the system draws up schedules based on simple algorithms. But such systems cannot take into account all the features of educational organizations, since they are developed in isolation from other educational process management needs. Also, these programs cannot make a schedule that would be well suited for both students and teachers due to the limited information and architecture of the program. As a result, the schedules generated by such programs either have many “windows” for teachers, or, in rare cases, violate public health regulations and standards.

## **2. Problem Statement**

Big data technologies can make up a more efficient timetable, eliminating possible problems due to the characteristics of the educational institution by analyzing similar precedents. The use of big data technologies for scheduling a school curriculum can be a good basis for the further development of a mass administration system for educational organizations, it will be possible to include information on student performance and other useful information in this system and use this data to connect neural networks to create individual educational programs in a mass system education.

## **3. Research Questions**

- 3.1. What are the ways to use big data technologies in education? Where can big data technologies be applied at school?

## **4. Purpose of the Study**

To show the potential of using big data technologies for the education system, in particular, for drawing up the school curriculum.

## **5. Research Methods**

At the first stage of our research, we used the literature analysis method.

## **6. Findings**

In modern educational process management, the use of big data technologies is at the stage of single and separated projects. In higher education management systems in foreign countries, the use of big data technologies is at the stage of transition from local experiments to full implementation at the international level.

### **6.1. Examples of the use of big data in the educational process of foreign countries**

Let us look at four examples of the successful use of big data technologies at universities, which have created effective systems that help students and simplify the process of managing educational organizations.

The University of Nottingham Trent in the UK, using descriptive analytics, was able to create a “student monitoring panel” that shows data on student involvement in the educational process. The data displayed on this “panel” is the frequency of work with the library fund, attending additional courses, attendance at classes and the use of electronic resources of the university. The main feature is that this data is public, and each student can monitor not only their successes, but also the successes of their classmates. If there is no activity on the “panel” of the student for two weeks, then the system immediately informs the tutor about this, who promptly responds and provides the necessary assistance to the student. After three years of using this system, seventy-two percent of freshmen noted that they had become more interested in studying, and they began to devote more time to it.

Using prescriptive analytics, Purdue University in the United States has developed a Course Signals system that monitors student performance and identifies lagging students who urgently need help. The definition of lagging students is based on information about the time a student spends on tasks, what types of exercises he does not, and what exercises he does quickly. Statistics are also kept on the history of student performance, their activity in the digital environment of the university’s electronic resources, and demographic data. Both the student and the course coordinator have access to this information. After applying this system, the number of deductions based on the results of the school year has significantly decreased.

Using prescriptive analytics at the University of Austin Pee, USA, a recommendation system Degree Compass (Compass) was developed that helps students choose courses and enroll in them. Prescriptive analytics allows to use data about previous student actions to predict and offer similar courses or information. The selection of courses for a student is based not only on his personal statistics, but also on general statistics for the entire existence of this system, which allows the system to work with ninety percent accuracy.

Using the same predictive analytics as in the previous example, Carnegie Mellon University, USA, created a system that allowed them to compose an individual learning path based on online courses. Students also received detailed statistics and on their basis selected further online courses. This system made it possible to reduce the time required for students to complete courses by half (Sinelnikov, 2018).

Big data technologies will soon change higher education, making it possible to make student learning more individualized: not only to choose their own course programs for everyone, but also to give a separate homework, as well as provide verification of the content assimilation. Students will receive more detailed recommendations on various topics and have an expanded information space. They will have the opportunity to choose their course program, complete a separate homework, and receive more detailed recommendations. With the help of big data, university groups will become noticeably less lagging behind, because big data technology will help identify students who may be at risk, and teachers will be able to more effectively help lagging students, as the program will indicate in which particular areas of knowledge there are problems. The system will also help adolescents in choosing a university: it is assumed that the

robots themselves will choose the best learning places for future students, they will not even have to submit an application. And graduating from the university, each student will have a digital portfolio that will help young professionals navigate the labor market, and employers in the selection of specialists.

In each of the above examples, big data technologies allow to manage the learning process more effectively than the classical methods of education management. Each of these universities will be able, after a small refinement, to use their systems to create class schedules, which will allow educational institutions to better distribute the load on students and improve the quality of each subject due to the correct arrangement in the classroom and the use of predictive analytics.

## **6.2. School timetable**

Currently, Russia uses manual scheduling and applies automated scheduling programs. The complexity of introducing such programs is the isolation of their platforms from other e-governance programs of educational institutions. The integration of these systems is a complex task that requires high-level programmers on staff.

Here are some examples. The NIKA program has a convenient interface and high performance, but the program does not provide for the possibility of organizing a balanced schedule for both students and teachers, due to the impossibility of the program to take into account all the possible organization of classes in educational institutions (Kirillov, 2009).

The program "Chronograph 3.0 Master" is also an automated system for compiling a school schedule, for the use of which it is necessary to perform many operations to fill out information about the educational organization. There is not enough data on the integration of this program into the electronic education management system, however, it is possible to create schedule web pages for the school site (Kulichenko, 2011).

Creating a school timetable is a multifactorial task.

An analysis of the recommendations for scheduling the school curriculum showed that one of the most important factors affecting regulation and / or scheduling is hygienic recommendations for the lesson schedule. Studies in the physiology and psychology of adolescents, the ability of students of different age groups to absorb information help determine the most effective time for classes.

So, according to modern hygiene requirements, the biorhythmic optimum of mental performance in school-age children falls on the interval of 10 a.m. - 12 a.m.. During these hours, the greatest efficiency of assimilation of the material is noted at the lowest psychophysiological costs of the body (Bezrukikh, 2008; Elkonin & Semchuk, 2006.).

The working capacity of students varies on different days of the school week. Its level rises by the middle of the week and remains low at the beginning and at the end of the week.

Another limitation is that items that require a lot of time for home preparation should not be grouped on the same day.

The time spent on the study of disciplines is regulated according to the Federal State Educational Standard and is described by the elements of the mandatory minimum content of the main educational programs. In the context of these elements, it is necessary to allocate the time necessary for the assimilation of the material.

In tables with a point scale, the difficulty of subjects for different classes for schoolchildren from grades 1 to 4 is distributed as follows: mathematics has eight points of difficulty, the Russian language (national, foreign language) - seven points, nature and computer science - six points, Russian (national) literature - five points, history (4 classes) - four points, drawing and music - three points, labor - two points and physical education - one point.

Since the complexity of objects in each class is different, the scale has different divisions for each class, for example, chemistry in the seventh grade has thirteen points, and in the eighth grade - ten points. For students in the tenth and eleventh grades, the scores are the same. For example, physics in both the tenth and eleventh grade has twelve points for complexity (Sanitary and epidemiological rules..., 2015).

However, practice shows that the factors mentioned above cannot always be taken into account, since in each particular educational organization the presence or absence of teachers, their load, the presence or absence of the necessary premises, etc. make their own adjustments.

To effectively compile the school curriculum, it is necessary to use big data technologies, which, based on statistics collected from all educational institutions, will be able to more efficiently. Based on descriptive analytics, one can quickly draw up schedules identify problems with a compiled class of classes according to performance data for each class and compare them. After all, even a schedule compiled correctly in accordance with all requirements may have problems for students to perceive the material because of the difficulty of switching attention from subject to subject, which is not taken into account in the complexity table.

## **7. Conclusion**

Almost all educational organizations in Russia work mainly with local data. This is due to the fact that educational institutions often lack a special electronic educational environment. Those organizations that have an electronic educational environment are mainly focused on filling content, rather than processing information about the use of online content, and do not use the capabilities of the environment for scheduling (Gvozdenko, Ishchenko, & Pilipenko, 2019).

For the problems of mass education, computer systems can be highly effective additional learning tools. Examples of the successful application of big data technologies have shown the ability of such systems to predict student performance based on statistics and optimize their educational trajectories. Such achievements are possible thanks to a personalized approach that takes into account the individual achievements of the student not only within the framework of one subject. The methods of objective data analysis, which form the basis of the algorithms of actions, allow us to calculate the patterns that arise in the learning process. And this in turn will help improve the learning process.

To solve problems with the automated scheduling of the school curriculum, it is necessary to use big data technologies in all educational organizations. In this case, it will be possible to monitor the correctness of the compilation of the school curriculum in each of them and create recommendations based on precedents. If the situation in the educational organization is specific and does not correspond to any of the previously recorded precedents, then big data technologies will help to effectively draw up the school curriculum.

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