Methodik zur verwendung von problem educational technologies beim lehren einfacher differenzgleichungen

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Abstrakt: Ziel der Studie ist es, die Methodik der Lehre des Moduls Differentialgleichungen im Hochschulbereich zu verbessern. Material und Forschungsmethoden. Die Ergebnisse der Untersuchung staatlicher Bildungsstandards und Qualifikationsstudierender in Mathematik an Hochschulen sowie der Untersuchung pädagogischer Praktiken im Bildungsprozess, Fragebögen, Interviews, Beobachtungen, Tests, experimentelle und mathematisch-statistische Analysemethoden waren Gebraucht.

Ergebnisse. Die Studie ergab, dass die Effektivität der entwickelten Methodik, also des Einsatzes problembasierter Lerntechnologien beim Unterrichten einfacher Differentialgleichungen, um 11% gestiegen ist.

Anmerkung. In diesem Artikel, Fallstudie, bietet Fishboun Anregungen und Empfehlungen zum Einsatz von Bildungstechnologien beim Unterrichten einfacher Differentialgleichungen.

Schlüsselwörter: Fallstudie, Fishbone, Differentialgleichung, problembasierte Lerntechnologie, xi-Quadrat.

Methodology of using problem educational technologies in teaching simple differential equations

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Abstract: The aim of the study is to improve the methodology of teaching the module of differential equations in higher education.

Material and research methods. The results of the study of state educational standards and qualification students in mathematics in higher education institutions, as well as the study of pedagogical practices used in the educational process, questionnaires, interviews, observations, tests, experimental and mathematical-statistical analysis methods were used.

Results. The study found that the effectiveness of the methodology developed, that is, the use of problem-based learning technologies in the teaching of simple differential equations, increased by 11%.

Annotation. In this article, Case-study, Fishboun offers suggestions and recommendations on the use of educational technologies in the teaching of simple differential equations.

Keywords: Case-study, Fishbone, differential equation, problem-based learning technology, xi-square.

Introduction. Today, special attention is paid to improving the teaching of science in higher education institutions on the basis of modern innovative technologies and the development of mechanisms to increase the effectiveness of teaching [1-6]. Therefore, the development of new approaches to improving the methodology of teaching differential equations in higher education has become a

requirement of the time [7-8]. Therefore, one of the urgent problems is to improve the methodology of using problem-based learning technologies in the teaching of differential equations in higher education institutions.

In this regard, the scientists D.Makhmudova, E.O.Sharipov, P.M.Aslanov, Y.N.Bibikov, I.S.Novikova, N.V.Sicheva, L.P.Kuzmina carried investigations on the methodology of teaching the module of differential equations in our country and the Commonwealth of Independent States, as well as the formation of students' competence in differential equations, however, their study did not specifically study the methodology of using problem-based learning technologies to improve the effectiveness of teaching lectures and practical exercises from the module of differential equations in higher education institutions. Therefore, one of the most pressing issues is the development of new approaches to the use of problem-based learning technologies in the teaching of the module of differential equations in higher education institutions.

Materials and research methods. Differential equations have their own terminology. In the process of learning, students do not always understand the importance of the knowledge gained on differential equations in their future careers. On the other hand, the interdisciplinary relationship of mathematics courses in higher education institutions studied in the curriculum is significant. In this regard, according to E.O.Sharipov, the general purpose of the topic "Differential equations" can be defined as "definition of differential equations, general and special solutions of differential equations, integration of first-order linear differential equations with integral line and variable". Focusing on the application of problems related to differential equations to physical, biological, and economic processes encourages students to think [9]. Therefore, solving examples and problems related to differential equations requires relying on pedagogical research to teach students how to apply them.

In higher education, students learn the modulus of simple differential equations when expressing differential equations in a homogeneous, linear form, and using substitutions to reduce the order of higher-order differential equations in finding a particular solution, they find it difficult to find an integrating multiplier [10]. In order to overcome these problems, it is advisable to use problem-based learning technologies, in particular Case-study and Fishbone technologies [11-12]. The following is a methodology for using simple differential equations in Case-study and Fishbone learning technologies.

Here are some suggestions on how to look or get an appointment for hair extensions: During the lesson, the professor asks the students what kind of differential equation can be formed when the order of these differential equations is reduced.	1. $yy'' = f(x)(y')^2$ 2. $yy''' - y'y'' = f(x)[y'y'' - (y')^2] + g(x)$ 3. $x^2 y'' + xy' = f(x^n e^{ay})$ 4. $y'' + f(y)(y')^4 + g(y)(y')^2 + h(y) = 0$

Based on the questions and answers, the professor uses Case-study technology to present the solution in the following table:

Case	Order Reduced Differential Equations	Substitutions	Order Reduced	Type
Case 1	$yy'' = f(x)(y')^2$	$\omega = \dfrac{xy'}{y}$	$x\omega' = \omega + [f(x) - 1]\omega^2$	Bernulli
Case 2	$yy''' - y'y'' = f(x)[y'y'' - (y')^2] + g(x)$	$\omega = y'y'' - (y')^2$	$\omega' = f(x)\omega + g(x)$	Linear
Case 3	$x^2 y'' + xy' = f(x^n e^{ay})$	$z = x^n e^{ay}, \omega = xy'$	$z(a\omega + n)\omega'_z = f(z)$	Variables are separable
Case 4	$y'' + f(y)(y')^4 + g(y)(y')^2 + h(y) = 0$	$\omega(y) = (y')^2$	$\dfrac{d\omega}{dy} + 2f(y)\omega^2 + 2g(y)\omega + 2h(y) = 0$	Rikkati

It describes the following algorithm for determining and finding the integrating multiplier:

$$M_y = \frac{\partial M}{\partial y}, N_x = \frac{\partial N}{\partial x}$$
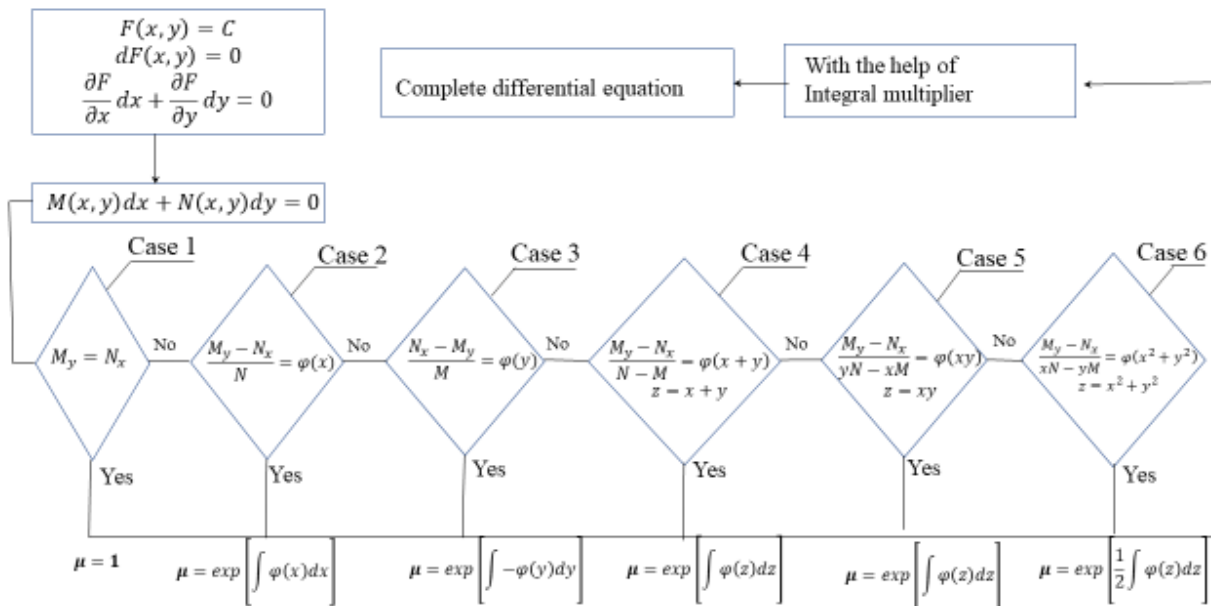
Students will be taught the Fishbone method to find a specific solution to a problem. This methodology is illustrated in the following diagram. The differential equations required to find a specific solution to the problem are given at the top of the diagram. The solution to the problem is shown at the bottom of the drawing.
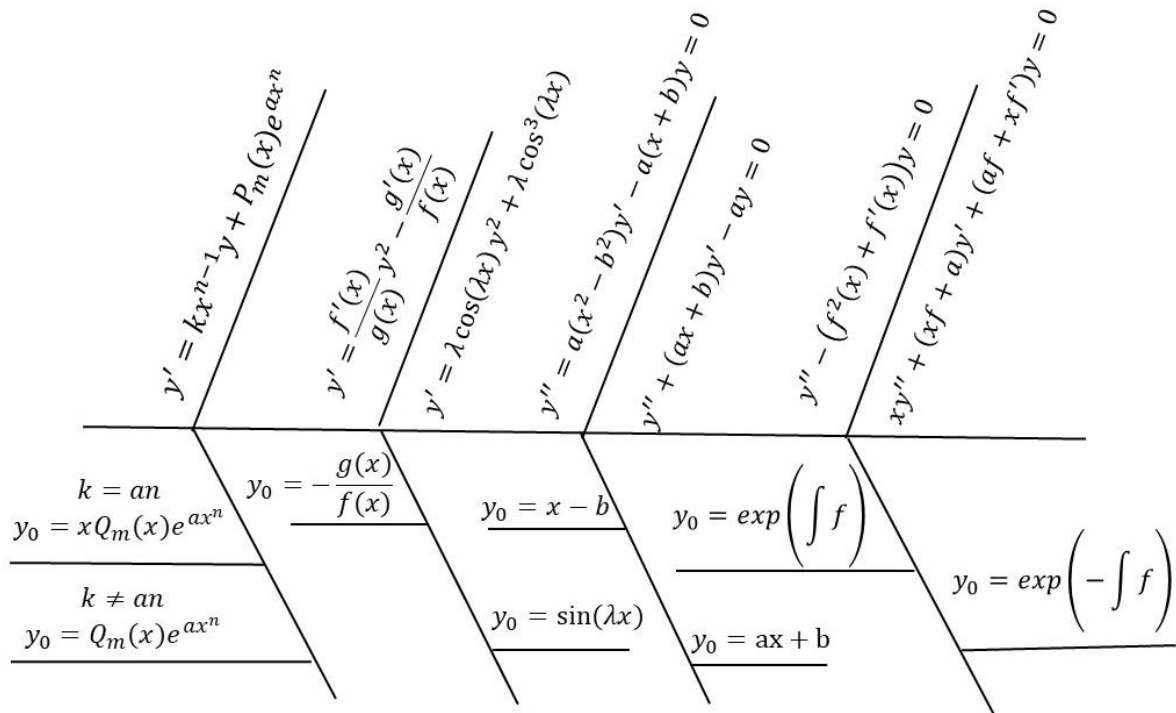
This method is effective in solving examples of differential equations. It focuses on students' logical thinking and independent research, based on the problem at hand. The result is the formation of students' creative thinking and the necessary competencies.

Research results. Methods have been developed to use problem-based learning technologies, such as Case-study and Fishbone, to teach simple differential equations. Experimental work was carried out to determine the level of effectiveness of this developed methodology.

Experimental work. In 2019-2021, Bukhara State University, Faculty of Physics and Mathematics, 106 students and 20 professors-teachers of Mathematics, Navoi State Pedagogical Institute, Faculty of Physics and Mathematics, Mathematics. 120 students and 30 professors-teachers of "Methods of teaching", 103 students of "Methods of teaching mathematics" of "Physics and Mathematics" faculty of Chirchik State Pedagogical Institute, 25 professors and teachers were involved. The students of the above-mentioned higher education institutions were divided into experimental and control groups to conduct experiments. Students were divided into experimental and control groups, and their knowledge was assessed orally, in writing, and through tests. Mathematical - statistical analysis was performed on the basis of the criteria (xi-square) of the results of students involved in this experimental work. Using this criterion, the formulas, $A\% = \frac{\bar{X}}{4} \cdot 100\% - \frac{\bar{Y}}{4} \cdot 100\%$ were used to determine the appropriate averages for the samples $\bar{X} = \frac{1}{n}\sum_{i=1}^{4} n_i X_i$, $\bar{Y} = \frac{1}{m}\sum_{j=1}^{4} m_j X_j$, the coefficients of dispersion $D_n = \sum_{i=1}^{4} \frac{n_i(x_i - \bar{X})^2}{n-1}$, $D_m = \sum_{j=1}^{4} \frac{m_j(y_j - \bar{Y})^2}{m-1}$, and the

assimilation rates. The calculation showed that the average mastering rate of the experimental group was higher than that of the control group, an increase of 11%.

Conclusions

1. During the research, we became convinced of the need to develop scientific guidelines for the use of case-study technology for professors and students of higher education institutions.

2. The use of problem-based learning technologies in the teaching of simple differential equations is advisable. In doing so, it enhances their logical and creative thinking by creating mentally challenging situations for students.

3. In the effective organization of classes on simple differential equations in higher education institutions, it is advisable to organize them on the basis of Case-study and Fishbone technologies. By increasing the activity of professors and students, the effectiveness of the lessons will increase and the student's interest in science will increase.

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