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APPLIED PROBLEMS IN TEACHING MATHEMATICS TO STUDENTS

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Abstract. The article highlights the importance of applied mathematics, design teaching, and the widespread use of computational mathematics in higher education to develop the abilities of mathematics students. The goal is to develop and assess applied problem-solving and design skills through interdisciplinary communication in guiding mathematics students toward professionalism. In the empirical method based on experience through the use of analytical geometry, differential equations, and computer graphics, students' understanding of applied mathematics, interest in it, ability to monitor one's own level of knowledge and work on one's mistakes and the development of memory, attention and understanding are important in shaping the process. That is, the course of the lesson with students includes the use of previously acquired knowledge, interdisciplinary connections, and their own theories, as well as observation, description, comparison, measurement, modeling, and literature study.

Project-based teaching is an activity that involves the creation of ideas in the minds of students and their active implementation. Teaching through applied problems based on design education is one of the most valuable achievements in didactics. Among them, the applied direction in teaching differential equations was considered in their works by researchers such as R.M. Aslanov, V.S. Kornilov, B.A. Naimanov, and others. However, in these works, the specific features of design and assessment in teaching applied problems are not observed. This work is based on the preparation for design through applied problems and the evaluation provided in the 2-literature. The prediction of the results of research methods serves as a stimulus for improving the cognitive activity of mathematics students, their own work, and their adaptation to design by considering the use of problems.

Keywords: teaching, activity, mathematics, differential equations, tangent, curve, ray, focus

Introduction

Methodology of teaching through applied problems is the use of various methods of drawing images (standard, non-standard, computer animations, computer mathematics systems or packages, etc.) in connection with the geometry course as a means of developing the professional abilities of students [1, p.327]. According to the methodology, the teacher is required to provide systematic and comprehensive education at the stages of solving applied problems. That is, specialists and future teachers of mathematics should be as fluent as possible in the theoretical foundations of Applied Problems and teaching methods. At present, academic freedom is given to the educational program of higher educational institutions and advanced efforts are being made to train specialists. The work presented in this direction deals with one of the problems of specific methodological preparation of teaching applied problems to future specialists in mathematics. At the same time, not just consider, but stimulate students ‘ interest in improving their independent work and using applied reports. Let’s focus on the following conclusion as one of the methods in this direction.

The history of the issue under consideration. Teaching through applied problems is one of the most valuable achievements in didactics. The effectiveness, advantage of education through interdisciplinary communication lies in the understanding of society, the integrity of the environment. This is also the opinion of many scientists. In particular, according to R. Descartes, it is more effective to teach subjects as a whole than to teach them separately. That is, teaching through interdisciplinary communication allows students to understand the subject with its comprehensive application, connection with life. There are works in the field of pedagogy, teaching mathematics through interdisciplinary communication. They were reflected in the dissertation of R. A. Darmenova on the topic “pedagogical conditions for the development of aesthetic taste of students on the basis of interdisciplinary communication” in 2007, in the book of V. A. Dalinger on the topic - formation of interdisciplinary understanding of students in the process of teaching mathematics in 2016, in the works of L. A. Aubambayeva on the topic - development of research skills of students through connecting teaching Physics, Mathematics in 2020. However, the study of elements of analytical geometry through differential equations, physics, computer programs, the formation of comprehensive practical views of students, it turns out that training on this topic is also relevant. However, these works do not reveal the specific features of design and assessment in teaching applied problems [2, p.289-299].

According to the views of N.Chebyshev and V.Kagan, the main task of training is to develop a holistic picture of the process of solving a professional problem, systematic thinking, the ability to see how the interrelation of the subject with other disciplines is a holistic pedagogical system, how the confrontation unfolds. Here the student:

- understanding the challenges of scientific research;
- collect comprehensive information about the report;
- formulate assumptions as expected solutions;
- comparative analysis of empirical actions;

- streamlining and defining decisions;
- the activity continues by applying the knowledge gained to solve new problems. The most basic idea in teaching through applied problems is modern teaching methods, the need for continuous improvement at the present time. From such data, the following goal was set for improving the knowledge of mathematical students.

The goal is to develop applied problem-solving (In the process of solving analytical geometry problems, elements of differential equations, drawing figures, and various computer optimization methods are used) skills and design competencies as a means of developing the professional abilities of mathematics students, to increase their systematization and evaluation activity. To achieve this goal, we take the following conditions.

The object of research is the development of mathematical students' skills in solving applied problems and designing.

The subject of research is the process of solving applied problems by students.

The hypothesis of the study is that if the process of solving problems is carried out correctly during the formation of applied problem-solving and design skills of mathematics students: professional interest increases, they monitor their level of knowledge, can work on their mistakes, their memory improves, and the process of developing understanding is formed.

Materials and Methods

The course of the lesson, prior knowledge, own theories on interdisciplinary connections, observation, description, comparison, measurement, modeling, and study of sources were considered with the students. *In the empirical method based on experience* through the use of analytical geometry, differential equations, and computer graphics, students' understanding of applied mathematics, interest in it, ability to monitor one's own level of knowledge and work on one's mistakes and the development of memory, attention and understanding are important in shaping the process.

Theoretically - by studying various sources, we identified the main requirements for the methodology of teaching applied problem solving.

First, the formation of teaching activity in the process of solving applied problems should be implemented at the following level of cognitive activity:

- preparation for search and research work;
- the ability to carry out search activities;
- increasing interest in creative activities;
- the ability to search for new methods and solve problems.

Secondly - it should be carried out by sequentially presenting all types of applied problems;

Thirdly - in order to implement the principle of developmental teaching, applied problems should be systematized by complexity;

Fourthly - applied problems should be aimed at forming control and evaluation components. As a result of the effective use of Applied Problems as an interdisciplinary connection [3, p.93-100], creative skills increase, and professional interest of students develops. The teacher's problems (thought-provoking actions) always contribute to the success of the learner's future research [4, p.347]. In order to increase the cognitive activity of the learner, let's conduct research on the use of geometry, taking into account the properties of natural ray close to the ray, which is one of the main research objects.

Problem 1. Usually, it is possible to send rays (heat, light) to the necessary places through reflective surfaces of the sun. Considering this, it is very important to consider surface reflections. It is known that after the ray is reflected from the surface, the energy released from it changes. Such regularities come from the optical consideration of the properties of light.

The ray incident on the surface is reflected by the tangent-projection applied to the surface, i.e., let's take a surface with a very high flatness, taking into account the pattern that the angle of the incident ray is equal to the angle of the reflected ray [5, p.637-640].

When rays of light reflected on a surface in space hit one of the surfaces, the light beam is reflected from the surface. We will discuss such reflections with respect to the calculation of angles or the reflection of the beam on the surface.

The calculations, questions and answers with students on this topic were in the following areas.

1) A brief overview of the physical concept was made, taking into account that he knows the mathematical definition of the name of the ray under consideration.

Questions for students:

- How do you understand the curve?
- Can the straight line be given in the form of a reference?
- Try to formulate the definition of ray?
- What would you say about the features and similarities between the use of these names of curves, straight lines, rays in mathematical and other fields?

2) To construct the equation of the parabola curve, the concept of ray was first explained in physical terms and the requirement was set to satisfy the conditions associated with its application (sought, let the function graph satisfy the condition: all rays from a given point be directed parallel to the axis when reflected).

- What do you mean by equation?
- Where did you try to use the word parabola before?
- What do you mean by the solution of the equation? That is, by asking such questions, we train students.

3) Drawings in computer programs were used for the conditions related to the definition of the curve.

4) From the conclusions of analytical geometry, we construct a simple differential equation.

5) We solve a simple differential equation by bringing it to a complete differential equation.

6) From the solution of the differential equation, we determine the sought curve in the initial problem.

7) It is formulated by the fact that the drawing of a geometric figure on a plane with such properties, which are found in large numbers in the technique, is a parabola.

Derivation of parabola equation. It is sought, that the graph of the function $ó = f(x)$ satisfies the following condition: all rays from given point O should be directed parallel to the axis Ox when reflected (figure 1).

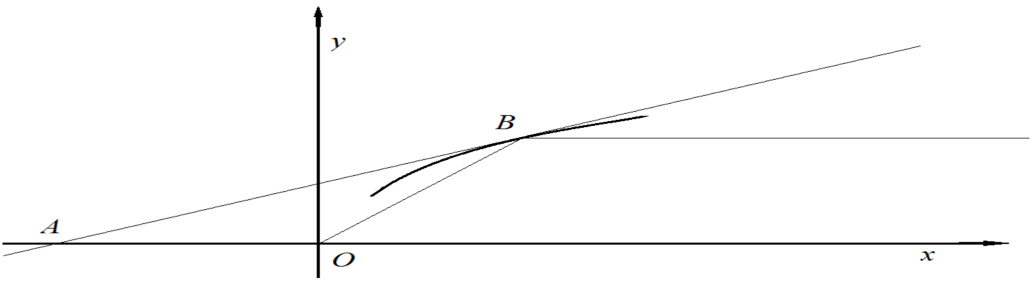

Figure 1 - Reflection of the beam in the Paint application

Solution. Let's choose the vertical axis parallel to the given direction. Let's say that the rays coming out of the given focus $O(0,0)$ fall on the point $ð(y,\ )$ of the graph of function.

Let's draw a tangent BA from a point $ð(y,\ )$ on the graph of the function.

Since the angle of incidence of the ray is equal to the angle of its return, the triangle ABO is equilateral. So,

$$y' = \frac{y}{\tilde{o} + \sqrt{\tilde{o}^2 + y^2}} \qquad (1)$$

equality is appropriate. Eliminating the irrati onality in the division of fractions,

$$\frac{dy}{d\tilde{o}} = \frac{y\left(\tilde{o} - \sqrt{\tilde{o}^2 + y^2}\right)}{\left(\tilde{o} + \sqrt{\tilde{o}^2 + y^2}\right)\cdot\left(\tilde{o} - \sqrt{\tilde{o}^2 + y^2}\right)} = \frac{y\left(\tilde{o} - \sqrt{\tilde{o}^2 + y^2}\right)}{-y^2} = \frac{\tilde{o} - \sqrt{\tilde{o}^2 + y^2}}{-y} \Rightarrow$$

$$\tilde{o}d\tilde{o} + ydy = \sqrt{\tilde{o}^2 + y^2}\, d\tilde{o}$$

or $\frac{\tilde{o}d\tilde{o}+ydy}{\sqrt{\tilde{o}^2+y^2}} = \eth$ (2)

we arrive at equality [6, p.102]. Since the left side (2) of equation is the complete differential of $\sqrt{\tilde{o}^2+y^2}$ the root,

$\eth\sqrt{\tilde{o}^2+y^2} = d\tilde{o}$ or

$$\sqrt{\tilde{o}^2+y^2} = \tilde{o}+C \qquad (3)$$

came out. We get the solution (a set of parabolas)

$$\tilde{y}^2 - 2C\tilde{o} = {}^2 \qquad (4)$$

from the equality (3). Here C is a constant.

Let's check whether the above given equation (4) is a parabola equation or not.

Now, as the coordinate of the focus $F\left(\frac{p}{2},0\right)$, let's choose $y=-\frac{p}{2}$ for the equation of the directrix (figure 2), [7, p.75].

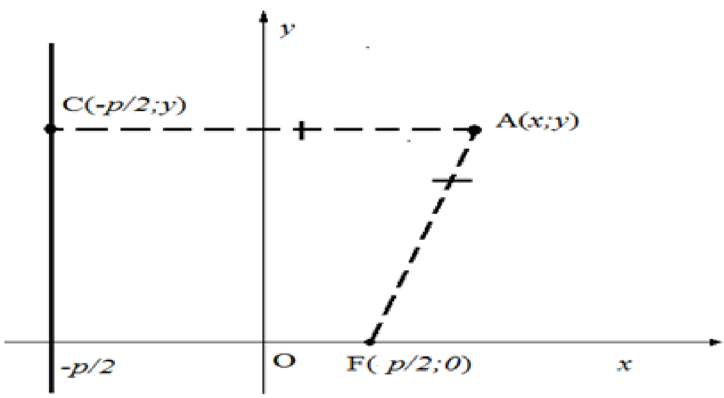

Figure 2 - The location of Point A in the Paint application at the same distance from the directrix and focus.

If we consider that the coordinate of any point of the parabola $A(x,y)$ is equal to the distance of the point from the focus and any point of the directrix,

$$|\grave{A}F| = |\grave{A}\tilde{N}| \Rightarrow \begin{cases} |\grave{A}F| = \sqrt{\left(x - \frac{p}{2}\right)^2 + y^2}, \\ |\grave{A}C| = \left|x + \frac{p}{2}\right| \end{cases} \Rightarrow \sqrt{\left(x - \frac{p}{2}\right)^2 + y^2} = \left|x + \frac{p}{2}\right|.$$

If we square both sides of the last equality

$$\left(x - \frac{p}{2}\right)^2 + y^2 = \left(x + \frac{p}{2}\right)^2 \text{ or}$$

$$y^2 = 2px \qquad (5)$$

if we transfer equation (4) from equations (5) and (4) to the initial coordinate

$y^2 = 2C\left(x - \frac{C}{2}\right)x + C^2$ or $y^2 = 2Cx$. (4) The equation (4) $p = C$ is the equation of a parabola with equality.

Properties of the canonical equation of the parabola:

1) since y has an even degree, it is symmetric to the axis of Ox;

2) $p > 0 \Rightarrow x \geq 0$, i.e., it is located on the right side of the axis of Oy.

We define commonly used paraboloid in order to make the space under consideration similar to a surface.

Incidence of rays on such reflective surface are re-reflected at some angle. A parabola is a plane drawing of geometric figure with such properties, which is often found in technology.

It is very effective to use computer software packages in the visualization of mathematical concepts and high-tech devices [8, p.288].

Problem 2. Design training prerequisite, physical and geometric data on beam reflection. The involvement of the teacher in creating and solving the design teaching situation also depends on the training of students. That is, the teacher himself sets the problem, gives the student the opportunity to find ways to solve it, to find the answer. For the development of students ‘ abilities, it is important to organize design training in a higher educational institution, create situations. A special place in the study is occupied by the widespread use of technical means, computer mathematics systems, etc. In solving applied problems, the specialty of mathematics serves as a stimulating method for improving the cognitive activity of students, independent work. At the same time, it is appropriate to use it as a basis for improving the teaching process of educational organization. Let's give the following information as a direction to motivate learners.

The density of thermal energy released from the sun will be relatively low. Due to the high cost of solar energy storage surfaces, the construction of a solar power plant is causing a problem. The difficulty in using photo elements depends on its expensiveness and the size of the area they occupy.

The paraboloid device is designed to collect heat energy from the sun or any light source or to convert it.

We know this device as an energy accumulator of a *simple paraboloid*

($y^2 = 2px$ - a surface formed when a parabola is rotated from the axis Ox). Let's modify this function a little. Of course, one can choose the device to automatically turn to light (sun) (figure 3).

Evaluation of the effectiveness of the reflective surface of the light. Let's describe the energy efficiency of this process physically to evaluate the effectiveness of the reflective surface. Suppose that the ray is reflected from the internal reflecting surface of the paraboloid. Let the rays from the right direction of the *Ox* axis to the left direction (opposite to the direction of the *Ox* axis). In this regard, the calculations, questions and answers with students were in the following areas.

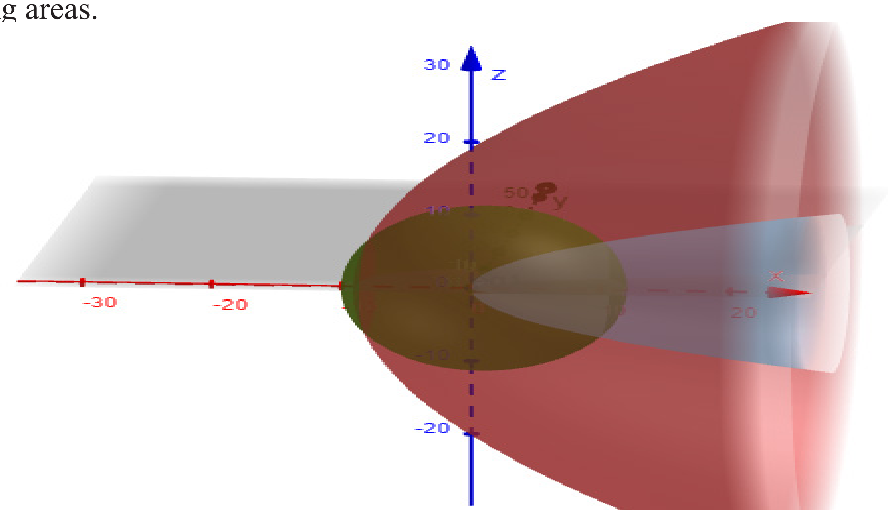

Figure 3 - GeoGebra, given the image bounded by the intersection lines of the surfaces $z^2 + y^2 = 8x$, $z^2 + y^2 = 44(x+9)$, $z^2 + y^2 + (x-2)^2 = 144$ in space and the surfaces between these common lines

1) The natural meaning of the ray in question is associated with the energy of the sun.

2) The mathematical name of the ray and the meaning of the word "ray" of the sun, which is used daily, are explained and connected. In order to interest students, the question of paraboloid was raised. Questions for students:

- what are the advantages of using light rays beam can they be calculated mathematically?

- does the sun's" ray " actually coincide with the mathematical definition of ray?

- try to formulate the definition of ray?

- does the light beam transmit or absorb energy?

2) He recalls the equations of a paraboloid, sphere, plane and draws the curves formed by their intersection in computer programs. Questions for students:

- can you tell the equation of the sphere?

- can you tell the equation of the plane?

- what conditions do you consider it necessary to meet for the intersection of a sphere and a plane? That is, by asking such questions, we learn the opinion of students.

3) Drawings in computer programs were used for the conditions related to the definition of the curve.

4) We recall the rules for calculating energy.

5) Learns to accumulate the focuses of parabolas in one point.

6) Examples are geometric shapes with such properties, which are found in large numbers in the technique.

If we say S the area of the cross-section of the plane perpendicular to the axis of symmetry of the paraboloid (the surface of the penetration of light rays into the paraboloid), the total energy of the reflecting surface

$$W_f = S \cdot W_s \qquad (6)$$

will be. Here S - the area of the surface of the rays entering the paraboloid, W_s - the energy of the rays entering the paraboloid from the S-surface, W_f - the energy of the rays accumulated at the focus of the paraboloid.

As a conclusion, the beam of rays collected at the focus directly depends on the area of the surface of penetration of the rays into the paraboloid. Therefore, if we increase the area of the reflective surface (when the penetration surface is constant), the pressure will be less on the surface, and if we decrease the area of the reflective surface, the pressure will be higher.

Results and discussion

Let's conduct a statistical analysis of the results of the learners in the group on the acquisition of given topic [9, p.2-4]. 21 learners of mathematics participated in the experimental group from South Kazakhstan University named after M.Auezov, 10 of them were in the experimental group, 11 were in the control group. We evaluate according to the number of learners in the class according to the Student distribution.

For ease of calculation methods, let's use Maple computer mathematics system [10, p.472]. According to the 100-point assessment system, the results of students of the experimental and control groups in accordance with the topic were given below.

```
> restart;
> x(1):=70:x(2):=95:x(3):=90:x(4):=90:x(5):=90:x(6):=90:x(7):=70:x(8):=95: x(9):=90:x(10):=90:y(1):=75:y(2):=90:y(3):=70:y(4):=90:y(5):=90:y(6):=80:y(7):=60:y(8):=80:y(9):=80:y(10):=65:y(11):=65:n1:=10:n2:=11:
> Digits:=10:
> M(x):=evalf(sum('x(i)',i=1..n1)/n1);M(y):=evalf(sum('y(i)',i=1..n2)/n2);
```

$$M(x) := 87.$$
$$M(y) := 76.81818182$$

```
> SS1:=evalf(sum('x(i)^2',i=1..n1)-(sum('x(i)',i=1..n1))^2/n1);SS2:=evalf(sum('y(i)^2',i=1..n2)-(sum('y(i)',i=1..n2))^2/n2);
```

$$SS1 := 760.$$
$$SS2 := 1163.636364$$

```
> SA1:=evalf((SS1/(n1-1))^(1/2));SA2:=evalf((SS2/(n2-1))^(1/2));
```

$$SA1 := 9.189365834$$
$$SA2 := 10.78719780$$

```
> Sm1:=evalf((SS1/((n1-1)*n1))^(1/2));Sm2:=evalf((SS2/((n2-1)*n2))^(1/2));
```

$$Sm1 := 2.905932629$$

$$Sm2 := 3.252462513$$

```
> t:=evalf((M(x)-M(y))/(((SS1+SS2)/(n1+n2-2)*(1/n1+1/n2))^(1/2)));
```

$$t := 2.315940214$$

According to this distribution, n1=10 –learners, n2=11- learners. Therefore, since df=19, the table value of df=19 is greater than the value of t=2,08600, that is, 2,0930<2,315940214. This means that the probability of making a wrong conclusion based on the results of the experiment is close to five out of one hundred (P<5% or $\alpha < 0,05$), we noticed that the experimental group showed a higher educational result on average [11, p.47-50]. From the correctness of the received assumption, it was found that the experimental works were performed correctly (diagram-1).

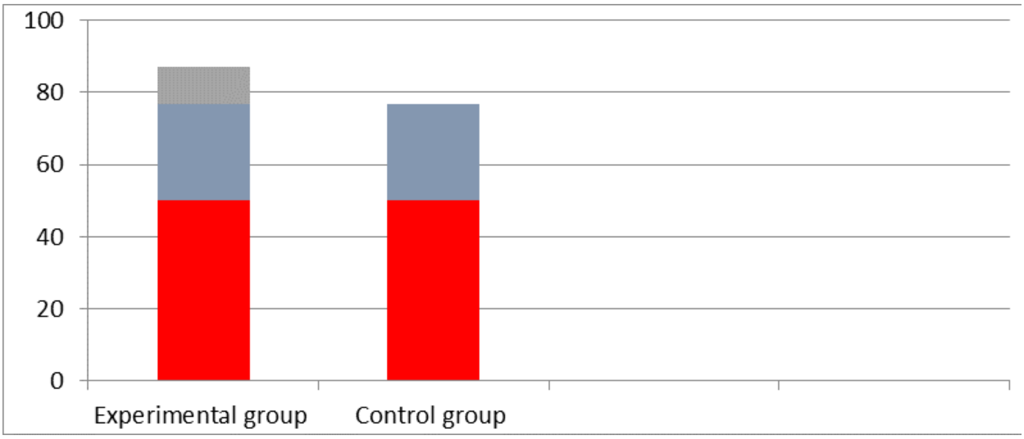

Diagram 1 - the level of qualification formation.

Much research is still needed to teach the elements of topics in mathematical disciplines through the use of computer-based mathematical systems for applied problems. Predictably, as modern learners become more fluent in new programs, research through math packages is shifting to the learner's independent work. The study of differential equations and elements of analytical geometry in a computer mathematics system allows bachelors of mathematics to effectively carry out design. It is known that the use of mathematical calculations by learners in the course of their independent work will bring the acquisition of the subject to a new level.

Conclusion

Our experience has shown that the level of student achievement in organizing teaching has significantly increased and the following results have been achieved:

- students' interest in applied problems and design improves in geometry and differential equations;
- students' ability to self-monitor their knowledge and work on their mistakes increases;
- develops logical thinking, memory and attentiveness.

Project-based teaching is directly related to research, so solving a problem can sometimes take a long time. However, educational technology is a type of education that develops the level of knowledge of students, in which students' mastery of scientifically prepared conclusions is combined with systematic self-search activity, and the system of teaching methods is built taking into account targeted predictions and principles. Here, the process of interaction between the teacher and learners is aimed at developing the personal qualities of learners and forming their personalities. The effectiveness of using project-based teaching technology in the teaching process was determined through reproductive and productive activities, that is, the connection between goal and action mastery was revealed.

REFERENCES

[1] Abylkasymova A.E., Tuyakov Y.A., Esetov Y.N., Kenzhebek Kh. A teaching method for constructing the line of intersection of two planes in a projection drawing //KazUIRandWL named after Ablaikhan "Bulletin". - 2024. - VL. 73. - № 2. - P. 326-344.

[2] Kalimbetov B. T., Omarova I. M., Sapakov D. A. Teaching bachelors of mathematics to display functions in the form of graphic images in the context of digitalization of Education // Bulletin of Yassawi university. –2023.–No 1 (127). - P. 215–224.

[3] Ibragimov, R., Kalimbetov, B., Kerimbekov, T. Methods for measuring the formation of design and research activity of students. //Academic Journal of Interdisciplinary Studies -2022. -11(6). - P. 92–102.

[4] Kalimbetov B., Kalmatayeva B., Ibragimov R., Omarova I. Training and research studies of future bachelor's mathematicians during the study limits //Opcion, Año 35, No. 88 (2019): - P. 346-363.

[5] I.B.Usembayeva, Sh. J. Ramankulov, D. K. Berdi, G. A. Saparbekova and B. S. Ualikhanova Procedure of Implementation the Applied Orientation of Future Teachers' Training Using ICT //American Journal of Applied Sciences. – 2015. - 12 (9): 636.643.

[6] I.B. Boykuziev. Differential equations: physics and mathematics. faculty. 1st ed. - T.: Ukituvchi, 1983. – 192 p.

[7] Bukenbaev K. B. Mathematics-1.- Petropavlovsk: M. Kozybayev NKSU, 2007, 398 p.

[8] Batyrbayeva A.M., Smagulova L.A., Zhiyembayev Zh., Seitova S.M. Methodology and thematic analysis of using electronic educational resources in university-level mathematics education: integrating pedagogical strategies and cognitive load considerations // KazUIRandWL named after Ablaikhan "Bulletin". -2024. - VL. 73. - № 2, - P. 287-302.

[9] Kalimbetov B.T., Kulakhmetova Sh. Teaching and learning differential equations in engineering studies by using low-level CAS commands. //World Transactions on Engineering and Technology Education. - 2022. - Vol.20, No.2. - 6 p.

[10] Aladiev V.Z., Boyko V.K., Rovba E.A. Programming in Maple and Mathematica Packages: A Comparative Aspect. - Grodno, 2011. – 517 p.

[11] Zhanbyrbayev B. S., Zhanbyrbaeva U. B. probability theory and Mathematical Statistics. - Almaty: Saga, 2006. -280 p.

БІЛІМ АЛУШЫЛАРДЫ МАТЕМАТИКАҒА ОҚЫТУДАҒЫ ҚОЛДАНБАЛЫ ЕСЕПТЕР

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Аңдатпа. Мақалада математик білім алушылардың қабілеттерін дамыту үшін жоғары оқу орнында қолданбалы есептерге, жобалау оқытуға, компьютерлік математиканы кеңінен пайдаланудың маңызы зор екендігі келтіріледі. Мақсаты - математик білім алушыларды кәсібилікке бағыттауда пәнаралық байланыс арқылы қолданбалы есептерді шығару мен жобалау дағдыларын дамыту, бағалау. Тәжірибеге сүйенетін эмпирикалық әдісте аналитикалық геометрия, дифференциалдық теңдеулер, компьютерлік кескіндеуді қолдану арқылы білім алушылардың қолданбалы есеп жайындағы түсінігінің, қызығушылығының артуы, білім деңгейін өзі бақылауы және қателіктері үстінде жұмыс жасай білуі, есте сақтауы, зейіні, түсінігінің дамуы үдерісі қалыптасуымен мәнді. Яғни, білім алушылармен жүргізілген сабақ барысы алдын меңгерген білімдерін, пәнаралық байланыс бойынша өзінік теорияларға және бақылау, сипаттау, салыстыру, өлшеу, модельдеулерді пайдалану, әдебиеттерді зерделеу жатады.

Жобалау оқыту білім алушылардың санасында құрылуы және оларды жүзеге асыру үшін белсенділігін көздейтін іс-әрекет. Жобалау білім беруге негізделген қолданбалы есептер арқылы оқыту - дидактикадағы ең құнды жетістіктердің бірі. Соның ішінде дифференциалдық теңдеулерді оқытудағы қолданбалы бағытты Р.М.Асланов, В.С.Корнилов, Б.А.Найманов және т.б. зерттеушілер өз жұмыстарында қарастырды. Бірақ бұл жұмыстарда қолданбалы есептерді оқытуда жобалау оқыту мен бағалаудың өзіндік ерекшеліктері байқалмайды. Бұл жұмыс қолданбалы есептер арқылы жобалауға дайындау және 2- әдебиетте берілген бағалауға сүйенеді. Зерттеу әдістерінің нәтижесінің болжамы есептердің қолданысын қарастыру арқылы математика мамандығы білім алушыларының танымдық іс-әрекетін, өзіндік жұмысын жетілдіруде ынталандырушы ретінде, жобалауға бейімдеуге қызмет етеді.

Тірек сөздер: оқыту, белсенділік, математика, дифференциалдық теңдеулер, жанама, қисық, сәуле, фокус

ПРИКЛАДНЫЕ ЗАДАЧИ В ОБУЧЕНИИ МАТЕМАТИКЕ СТУДЕНТОВ

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Аннотация. В статье подчеркивается важность прикладной математики, проектного обучения и широкого использования вычислительной математики в высшем образовании для развития способностей студентов-математиков. Целью является развитие и оценка навыков решения прикладных проблем и проектирования посредством междисциплинарные связи, направления студентов-математиков к профессионализму. В эмпирическом методе, основанном на опыте аналитическая геометрия важна тем, что она формирует основу для разработки дифференциальных уравнений, повышение понимания и интереса учащихся к прикладной математике посредством использования компьютерной графики, умения самостоятельно контролировать свои знания и работать над ошибками, памяти, внимания и понимания. То есть ход занятия со студентами включает использование ранее полученных знаний, межпредметных связей и собственных теорий, а также наблюдение, описание, сравнение, измерение, моделирование, изучение литературы.

Проектное обучение – это деятельность, которая предполагает создание идей в сознании учащихся и их активную реализацию. Обучение с помощью прикладных задач на основе проектного метода является одним из наиболее ценных достижений дидактики. Среди них прикладное направление в преподавании дифференциальных уравнений рассматривали в своих трудах такие исследователи, как Р.М. Асланов, В.С. Корнилов, Б.А. Найманов и другие. Однако в этих работах не прослеживается специфика проектирования обучения и оценки при обучении прикладным задачам. Данная работа основана на оценке, представленной в 2-литературе, и подготовке к проектированию с помощью прикладных задач. Прогнозирование результатов методов исследования служит стимулом для совершенствования познавательной деятельности студентов-математиков, их собственной работы, адаптации их к проектированию с учетом использования задач.

Ключевые слова: обучения, деятельность, математика, дифференциальных уравнений, косательная, кривая, луч, фокус

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