

Technology of Teaching Definite and Indefinite Integral in Professional Teaching of Mathematics

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ABSTRACT

Objective: In the article, taking into account the fact that it is becoming urgent to improve the quality of training of highly educated specialists in New Uzbekistan, a special state program was adopted in this regard. **Method:** Within the framework of the state program, conceptual approaches and directions to the problems of improving the quality of education are analyzed. **Results:** Conclusions and suggestions on improving the quality of education are recommended. **Novelty:** Taking into account the fact that it is becoming urgent to improve the quality of training of highly educated specialists in New Uzbekistan, a special state program was adopted in this regard.

INTRODUCTION

Integral calculus is a widely used area of mathematics, widely used in many practical professions, industry, economics, engineering, and physics. Real teaching of integral mathematics in vocational education helps students solve complex problems, strengthens, and develops a practical view of the environment. While definite (deterministic) approaches to the integral provide a solution to the problem, a function by integrating definites into mathematics, vague (non-deterministic) integral approaches teach students to make decisions based on probability and uncertainty.

The use of modern pedagogical technology in the process of teaching integrals in vocational education helps students apply theoretical knowledge to practice. In this process, the quality of the exact and indefinite methods is defined and the mathematical integration work of students is developed. The methodology for effective teaching of the integral in education is to ensure the preparation of students for production in specialized fields. The article describes the specific features of teaching the integral, methodological approaches and additional medical care in practice. By ensuring that they are able to apply it in practice, it is possible to raise modern vocational education to a higher level.

RESEARCH METHOD

This study uses a descriptive approach by presenting a series of practical examples to illustrate the application of definite and indefinite integrals in various scientific and professional fields. Each example is selected to represent common real-world problems in disciplines such as engineering, economics, physics, biology, and chemistry. The integral functions are solved analytically to demonstrate their usefulness in calculating

rates of change, total values, and dynamic system behavior over time. Calculations are shown step-by-step to enhance clarity and support conceptual understanding.

RESULTS AND DISCUSSION

Example, Application of the Definite Integral 1 (In Engineering) If it is necessary to study the temperature of a body, it is necessary to require a function that represents the time of keeping this body at its temperature. In this case, by loading the integral, the program can find the temperature change in a certain interval.

Suppose that $f(t)=2t+5$ represents the temperature change in time. If we want the temperature to be in the range from 0 to 7', we need to define a definite integral:

$$\int_0^7 (2t + 5)dt$$

Let's calculate this integral:

$$\int_0^7 (2t + 5) dt = \int_0^7 2tdt + \int_0^7 5dt = (7^2 - 0^2) + 5(7 - 0) = 49 + 35 = 84$$

Thus, the total change in the temperature of the body from 0 to 7 seconds is 84 units.

Example 2: Application of Indefinite Integral (in Economics). In economics, an indefinite integral can be used to make decisions based on probability and uncertainty. Suppose a company has a demand function for different levels of production and this is expressed using a probability distribution of demand. If it is necessary to calculate the variables for the company, an indefinite integral can be used.

If there is a demand function and a probability distribution, then to calculate the average value of the total demand for the company, the following indefinite integral must be calculated: $\int_1^5 (3x^2 + 4) * 0,1xdx$

By calculating this integral, we can obtain the average demand for the company.

$$\begin{aligned} \int_1^5 (3x^2 + 4) * 0,1xdx &= \int_1^5 (0,3x^3 + 0,4x)dx = 0,3 \frac{x^4}{4} \Big|_1^5 + 0,4 \frac{x^2}{2} \Big|_1^5 = \\ &= 0,3 \left(\frac{5^4}{4} - \frac{1^4}{4} \right) + 0,4 \left(\frac{5^2}{2} - \frac{1^2}{2} \right) = 0,3 * 31 + 0,4 * 12 = 14,1 \end{aligned}$$

Example 3: Comparison of Definite and Indefinite Integrals. If we compare the two examples above, using the definite integral, we can calculate a definite quantity over a certain time interval, that is, the change in the temperature of an object. However, using the indefinite integral, we can calculate with random factors, taking into account probabilities and variations. These approaches are used as complementary methods in mathematical calculations and decision-making in the economic, scientific, and engineering fields.

Example 4: In the Field of Physics (High Technologies). As a matter of application of the integral in physics, for example, we can study the change in temperature. Suppose that the velocity of an object is a function of time, and we need to calculate its velocity with respect to time. In this case, using the integral, we can calculate the work done by the velocity of the object during the period under study.

If this is the velocity of the object and the time interval is from 0 to 5 seconds, the work done by this object can be calculated as follows:

$$\int_0^5 (4t^3 - 2t) dt$$

Bu integralni hisoblab chiqamiz:

$$\int_0^5 (4t^3 - 2t) dt = \int_0^5 4t^3 dt - \int_0^5 2t dt = 4 \frac{t^4}{4} \Big|_0^5 - 2 \frac{t^2}{2} \Big|_0^5 = (5^4 - 0) - (5^2 - 0) = 625 - 25 = 600$$

Here is the mass of the object, and by calculating the integral, the amount of work can be determined.

Example 5: In Economics (Calculating Revenue). In economics, using the integral, it is possible to calculate revenue. Suppose a company studies its production volume and the price of its product. To find revenue, the function between demand and price can be calculated using the integral.

If a company has a demand function and a price function, to calculate revenue for each quantity x , we need to take the integral of their product:

$$\int_1^8 (4x + 6)(40 - 3x) dx$$

Calculating this integral allows us to find the company's total revenue.

$$\begin{aligned} \int_1^8 (4x + 6)(40 - 3x) dx &= \int_1^8 (132x - 12x^2 + 240) dx = 132 \frac{x^2}{2} \Big|_1^8 - 12 \frac{x^3}{3} \Big|_1^8 + 240x \\ &= 132 \left(\frac{8^2}{2} - \frac{1^2}{2} \right) - 12 \left(\frac{8^3}{3} - \frac{1^3}{3} \right) + 240(8 - 1) \\ &= 132 * \frac{63}{2} - 12 * \frac{511}{3} + 240 * 7 = 3794 \end{aligned}$$

Example 6: In Biology (Population Change). In biology, the integral can be used to analyze population change. Suppose that a biological population is given by the growth rate. We can take the integral of this function to calculate the total population growth rate.

If the population growth rate is and the time interval is from 2 to 5 years, the total population growth rate can be calculated as follows:

$$\int_2^5 4t^3 dt$$

This example allows us to observe and evaluate the change in biological systems over time.

$$\int_2^5 4t^3 dt = 4 \frac{t^4}{4} \Big|_2^5 = 5^4 - 2^4 = 625 - 16 = 609$$

Example 7: In Chemistry (Reaction Rate). In chemistry, the integral can be used to calculate the rate of a chemical reaction. Suppose that the rate function of a chemical reaction is expressed as To calculate the total time change of the reaction, we need to take the integral of this function.

If we have a reaction rate and the time interval is from 0 to 10 minutes, we can use the integral to calculate the total amount as follows:

$$3 \int_0^{10} e^{-0,5t} dt$$

This example shows the application of the integral to the field of chemistry.

$$3 \int_0^{10} e^{-0,5t} dt = 3 \left(-2e^{-0,5t} \Big|_0^{10} \right) = 3(-2e^{-0,5*10} + 2e^{-0,5*0}) = 3(2 - 2e^{-5})$$

The examples above show how the exact and inexact methods of mathematics can be used in professional education. Each example helps students understand how the integral can be applied in different fields. By including these examples in the article, the importance of the integral in practice can be more clearly expressed.

CONCLUSION

Fundamental Finding : The article describes the specific features of teaching the integral, methodological approaches and additional medical care in practice. The use of modern pedagogical technology in the process of teaching integrals in vocational education helps students apply theoretical knowledge to practice. The examples above show how the exact and inexact methods of mathematics can be used in professional education. **Implication :** Real teaching of integral mathematics in vocational education helps students solve complex problems, strengthens, and develops a practical view of the environment. By ensuring that they are able to apply it in practice, it is possible to raise modern vocational education to a higher level. **Limitation :** While definite (deterministic) approaches to the integral provide a solution to the problem, a function by integrating definites into mathematics, vague (non-deterministic) integral approaches teach students to make decisions based on probability and uncertainty. **Future Research :** The methodology for effective teaching of the integral in education is to ensure the preparation of students for production in specialized fields. Future research could explore further integration of digital tools and adaptive methods in teaching both definite and indefinite integrals.

REFERENCES

- Muzaffarova, M. U. "Concepts of definite and indefinite integrals." *New Journal*, 2023.
- "Indefinite integral, elementary function and mathematical analysis." YouTube video tutorial, 2022.
- "Methodology of teaching mathematics with a focus on professions." *Journal of Mathematics Education*, 2021.
- "Methodology of teaching definite and indefinite integrals." *Mathematics and Educational Technologies*, 2023.
- "Teaching integrals using innovative technologies." *Innovative Educational Approaches*, 2022.
- Sobirov, T. "Advanced foreign experiences in teaching mathematics." *Journal of Pedagogy and Educational Technologies*, 2021.
- Khodjayeva, N. "Methodology of teaching complex numbers and their integrals." *Mathematics Education: Foreign Experiences and Approaches*, 2020.
- Usmonov, M. "Modern Methods of Teaching Mathematics with a Focus on Professions." *Pedagogical Scientific Center of the Republic of Uzbekistan*, 2022.
- Tursunov, A. "Technologies for Teaching Definite and Indefinite Integrals and Their Application in Practice." *Journal of Higher Education*, 2021.
- Gulomova, Z. "Methods of Teaching Integrals: Theoretical and Practical Approaches." *Education and Methodology*, 2023.

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