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METHODOLOGY FOR DEVELOPING LOGICAL AND CREATIVE ABILITIES OF PRIMARY SCHOOL STUDENTS BASED ON THE ADDIE MODEL

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Abstract:

The article discusses the possibilities of using modern pedagogical technology - the ADDIE model - to develop the intellectual potential of primary school students. During the study, the impact of organizing educational processes based on five stages (analysis, design, development, implementation and evaluation) on the logical thinking and creative activity of students was studied. The article describes the methodology for designing special tasks and educational materials for primary school students. The results show that lessons organized on the basis of a systematic approach develop students' skills in overcoming problem situations and non-standard thinking.

Keywords: ADDIE model, primary education, logical thinking, creative ability, instructional design, educational efficiency.

Introduction

ADDIE MODELI ASOSIDA BOSHLANG‘ICH SINF O‘QUVCHILARINING MANTIQIY VA IJODIY QOBILIYATLARINI RIVOJLANTIRISH METODIKASI

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Annotatsiya

Maqolada boshlang‘ich sinf o‘quvchilarining intellektual salohiyatlarini rivojlantirishga zamonaviy pedagogik texnologiya – ADDIE modelidan foydalanish imkoniyatlari yoritilgan. Tadqiqot davomida ta’lim jarayonlarini besh bosqich (tahlil, loyihalash, ishlab chiqish, amalga oshirish va baholash) asosida tashkil etishning o‘quvchilar mantiqiy fikrlashi va ijodiy

faolligiga ta’siri o‘rganilgan. Maqolada boshlang‘ich sinf o‘quvchilari uchun mo‘ljallangan maxsus topshiriqlar va o‘quv materiallarini loyihalash metodikasi bayon etilgan. Natijalar shuni ko‘rsatadiki, tizimli yondashuv asosida tashkil etilgan darslar o‘quvchilarda muammoli vaziyatlardan chiqish va nostandart fikrlash ko‘nikmalarini shakllantiradi.

Kalit so‘zlar: ADDIE modeli, boshlang‘ich ta’lim, mantiqiy tafakkur, ijodiy qobiliyat, pedagogik dizayn, ta’lim samaradorligi.

Аннотация

В статье рассматриваются возможности использования современной педагогической технологии – модели ADDIE – для развития интеллектуального потенциала учащихся начальной школы. В ходе исследования изучалось влияние организации образовательных процессов на основе пяти этапов (анализ, проектирование, разработка, реализация и оценка) на логическое мышление и творческую деятельность учащихся. В статье описана методология разработки специальных заданий и учебных материалов для учащихся начальной школы. Результаты показывают, что уроки, организованные на основе системного подхода, развивают у учащихся навыки преодоления проблемных ситуаций и нестандартного мышления.

Ключевые слова: модель ADDIE, начальное образование, логическое мышление, творческие способности, педагогический дизайн, эффективность обучения, системный подход.

Introduction

One of the main tasks facing the modern education system is not just to give students ready-made knowledge, but to form in them the skills of independent, logical and creative thinking. In particular, the primary school period is considered the most active stage of human intellectual development. However, traditional educational methods cannot always fully reveal their individual creative potential. Therefore, the use of the ADDIE model, which is widely used in foreign experience, in the systematic design of educational processes is of urgent importance.

Main Part

The ADDIE model is the most reliable methodological basis for creating didactic games or software for primary school students. This model closely helps to systematize educational processes and guarantees high efficiency. We will consider the creation of a software project on the topic of primary school mathematics, “Logical Mathematics”, using the ADDIE model as an example.

1. Analysis. At this stage, the questions "For whom?", "For what?" and "Under what conditions?" are required to find answers to the questions.
Target classes: 7-10 year old students. They often have attention deficit disorder, and they also have strong visual perception.
Problem: difficulty in solving logical problems and low interest in them among primary school students.
Technical capabilities: computers, interactive whiteboards, etc.

2. Design. Here, an educational structure is created.
Learning objectives: Based on "Bloom's Taxonomy" (for example, "The student distinguishes geometric shapes presented in the images and can distinguish the necessary shapes from them").
Scenario (storyboarding): the hero of the game is "Excellent student or wise man". "Wise man's journey". Here, each obstacle in the wise man's journey is represented as a single logical task.
Interface design: large buttons, bright colors, and voice prompts.

3. Development. At this stage, the project is transformed into a real product.
Programming: the algorithms mentioned above can be coded (for example, using Scratch or Python).
Content creation: preparation of logical tasks, puzzles, tests, and multimedia (audio-video) elements.

Testing: checking for technical errors in the program.
4. Implementation. Using the finished product in teaching processes.
Approval: testing the program in a selected separate group.
Guidance: providing methodological recommendations to the primary school teacher on which part of the lesson (basic or reinforcement) to use this program.

5. Evaluation. Before evaluating, the results must be analyzed.
Formative assessment: during the game, that is, at what stage of the game did the students make the most mistakes? (for the purpose of improving the program).

Summative assessment: by what percentage did the level of logical thinking of elementary school students increase after the program was implemented? (can be done through monitoring or testing).

ADDIE Phase	Practical expression in primary education
Analyze	Study of age psychology of students and knowledge gaps
Design	Creating a didactic game scenario and the "Knowledge-Understanding-Application" chain
Develop	Creating interactive tasks and a visual hero image
Implement	Organizing the lesson process using a computer or Smart board

Below are two possible outcomes:

1. A short script/storyboard and instructions for implementing it in Scratch (for teachers/students);
2. A finished software product in Python (tkinter) – a game called “Bilagon’s Journey” with large buttons, bright colors, and voice control. Choose one of your favorite games (pyttsx3 is required).

Code and results for the game “Bilagon’s Journey” in Python:

```
# game.py — Oddiy ta'limiy o'yin "Bilag'on sayohati"
# Talab: Python 3.x, tkinter (standart).
# Ovozli boshqarish uchun (ixtio'riy) pyttsx3 versiyani o'rnating: pip install pyttsx3
import tkinter as tk
from tkinter import messagebox
import random
# Ovozni chiqarishga urunib ko'rish (pyttsx3). Agar lozim bo'lmasa zaglushka qo'yamiz.
try:
    import pyttsx3
    tts_engine = pyttsx3.init()
    def speak(text):
        tts_engine.say(text)
        tts_engine.runAndWait()
except Exception:
    tts_engine = None
    def speak(text):
        # Zaglushkani konsol yordamida pechatga chiqarish mumkin
        print("SPEAK:", text)
# Darajalarni aniqlash (har bir daraja savol, variantlar va to'g'ri javob indeksiga ega lug'atdir)
levels = [
    {
        "title": "Matematik to'siq",
        "text": "5+3= nimaga teng?",
        "options": ["6", "8", "9"],
        "correct": 1
    },
    {
        "title": "Ketma-ketlik",
        "text": "2, 4, 6, ... qatorni qaysi son davom ettiradi?",
        "options": ["7", "8", "10"],
        "correct": 1
    },
```

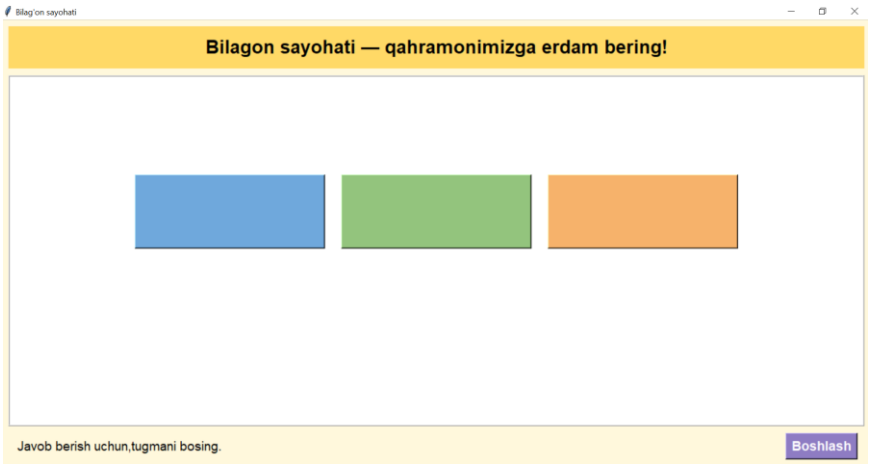
```
    {
        "title": "Mantiq",
        "text": "Nima mos kelmaydi: Olma, banan, sabzi?",
        "options": ["Olma", "banan", "sabzi"],
        "correct": 2
    }
]
class Game:
    def __init__(self, root):
        self.root = root
        self.root.title("Bilag'on sayohati")
        self.root.geometry("800x520")
        self.root.configure(bg="#FFF8DC")

        # Yuqori panel — bilag'on ba unung taraqqiyoti
        self.header = tk.Frame(root, bg="#FFD966", height=100)
        self.header.pack(fill=tk.X, padx=10, pady=10)

        self.title_label = tk.Label(self.header,
                                    text="Bilagon sayohati — qahramonimizga erdam bering!",
                                    font=("Helvetica", 20, "bold"),
                                    bg="#FFD966")
        self.title_label.pack(pady=12)

        # Markaz — savol
        self.center = tk.Frame(root, bg="#FFFFFF", bd=2, relief=tk.RIDGE)
        self.center.pack(fill=tk.BOTH, expand=True, padx=10, pady=(0,10))

        self.level_title = tk.Label(self.center, text="", font=("Helvetica", 18), bg="#FFFFFF")
        self.level_title.pack(pady=(20,10))

        self.question_label = tk.Label(self.center, text="", font=("Helvetica", 24, "bold"),
                                       bg="#FFFFFF", wraplength=700, justify="center")
        self.question_label.pack(pady=(0,20))

        # Javoblar tugmalari (Katta o’lchamda)
        self.buttons_frame = tk.Frame(self.center, bg="#FFFFFF")
        self.buttons_frame.pack(pady=10)

        self.option_buttons = []
```

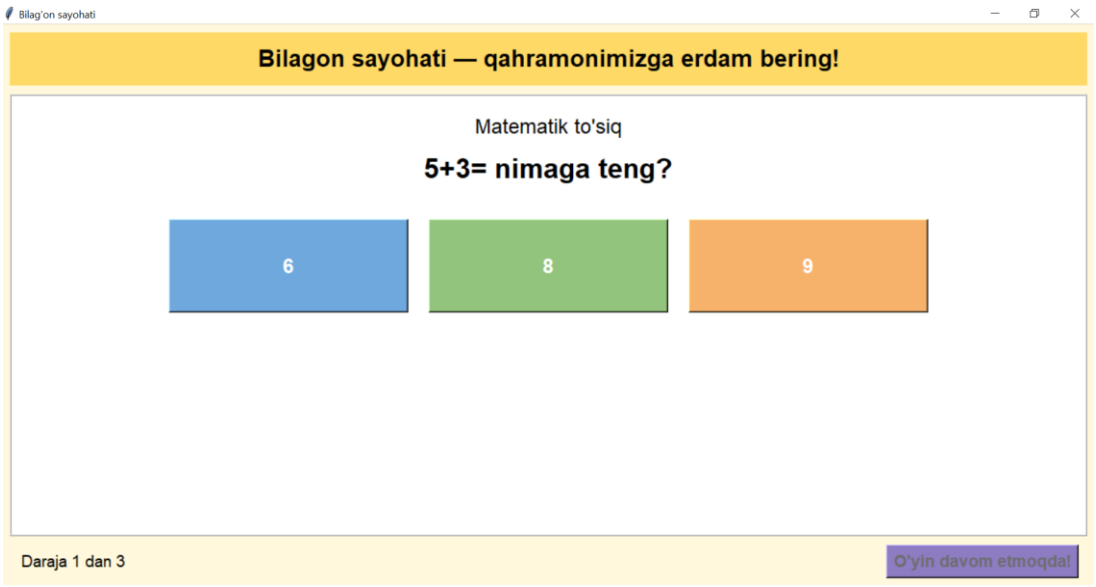
```
        colors = ["#6FA8DC", "#93C47D", "#F6B26B"]
        for i in range(3):
            btn = tk.Button(self.buttons_frame, text="", font=("Helvetica", 18, "bold"),
                            width=18, height=3, bg=colors[i], fg="#ffffff",
                            command=lambda idx=i: self.check_answer(idx))
            btn.grid(row=0, column=i, padx=12, pady=8)
            self.option_buttons.append(btn)

        # Pastki panel — maslahatlar/taraqqiyot
        self.footer = tk.Frame(root, bg="#FFF8DC", height=60)
        self.footer.pack(fill=tk.X, padx=10, pady=(0,10))

            self.hint_label = tk.Label(self.footer, text="Javob berish uchun,tugmani bosing.",
bg="#FFF8DC",
                                   font=("Helvetica", 14))
        self.hint_label.pack(side=tk.LEFT, padx=10)

        self.next_button = tk.Button(self.footer, text="Boshlash", font=("Helvetica", 14, "bold"),
                                     bg="#8e7cc3", fg="#fff", command=self.start_game)
        self.next_button.pack(side=tk.RIGHT, padx=10)

        # Game state
        self.current = 0
        self.score = 0

    def start_game(self):
        self.current = 0
        self.score = 0
        self.next_button.config(state=tk.DISABLED, text="O'yin davom etmoqda!")
        self.load_level(self.current)

    def load_level(self, idx):
        if idx >= len(levels):
            self.finish_game()
            return
        level = levels[idx]
        self.level_title.config(text=level["title"])
        self.question_label.config(text=level["text"])
        opts = level["options"].copy()
        # Variantlarni aralashtirish mumkin, buning uchun to‘g‘ri indeksni bilishingiz lozim!
```

```
        # Soddalik uchun variantlarni aralashtirmaymiz!
        for i, btn in enumerate(self.option_buttons):
            btn.config(text=opts[i], state=tk.NORMAL)
        self.hint_label.config(text=f"Daraja {idx+1} dan {len(levels)}")
        # Savolni ovozli etkazish
        speak(level["text"])

    def check_answer(self, idx):
        level = levels[self.current]
        correct_idx = level["correct"]
        if idx == correct_idx:
            self.score += 1
            self.give_feedback(True)
        else:
            self.give_feedback(False)
    def give_feedback(self, correct):
        if correct:
            speak("To'g'ri ofarin!")
            self.hint_label.config(text="To'g'ri! Keyingi to'siqga o'tamiz.")
            # Kichik animasiya: sarlavha rangini o'zgartirish
            self.title_label.config(bg="#CFE2F3")
            self.root.after(600, lambda: self.title_label.config(bg="#FFD966"))
            # Tugmalarni bloklaymiz, keyingisiga o'ting
            for b in self.option_buttons:
                b.config(state=tk.DISABLED)
            self.root.after(1200, self.next_level)
        else:
            speak("Noto'g'ri. Yana bir marta urinib ko'ring")
            self.hint_label.config(text="Noto'g'ri. Yana bir marta urinib ko'ring")
              # Kichkina o'rdam: 2 ta urinishdan so'ng to'g'ri javobni vaqtincha ajratib ko'rsatish
(oddiylik uchun biz urinishlarni hisobga olmaymiz)
            # Bu yerda maslahatlar mantiqini kengaytirish mumkin.
    def next_level(self):
        self.current += 1
        if self.current < len(levels):
            self.load_level(self.current)
        else:
            self.finish_game()
    def finish_game(self):
        speak("Tabriklaymiz! Barcha to'siqlardan o'ttingiz!")
```

```
        message = f"Tabriklaymiz! Barcha to'siqlardan o'ttingiz! To'g'ri javoblar soni: {self.score}
dan {len(levels)}"
        messagebox.showinfo("Galaba", message)
        self.next_button.config(state=tk.NORMAL, text="O'yinni qayta boshlaysizmi?")
        self.hint_label.config(text="Qayta boshlash tugmasini bosing.")
        self.level_title.config(text="")
        self.question_label.config(text="")

if __name__ == "__main__":
    root = tk.Tk()
    game = Game(root)
    root.mainloop()
```

Results:





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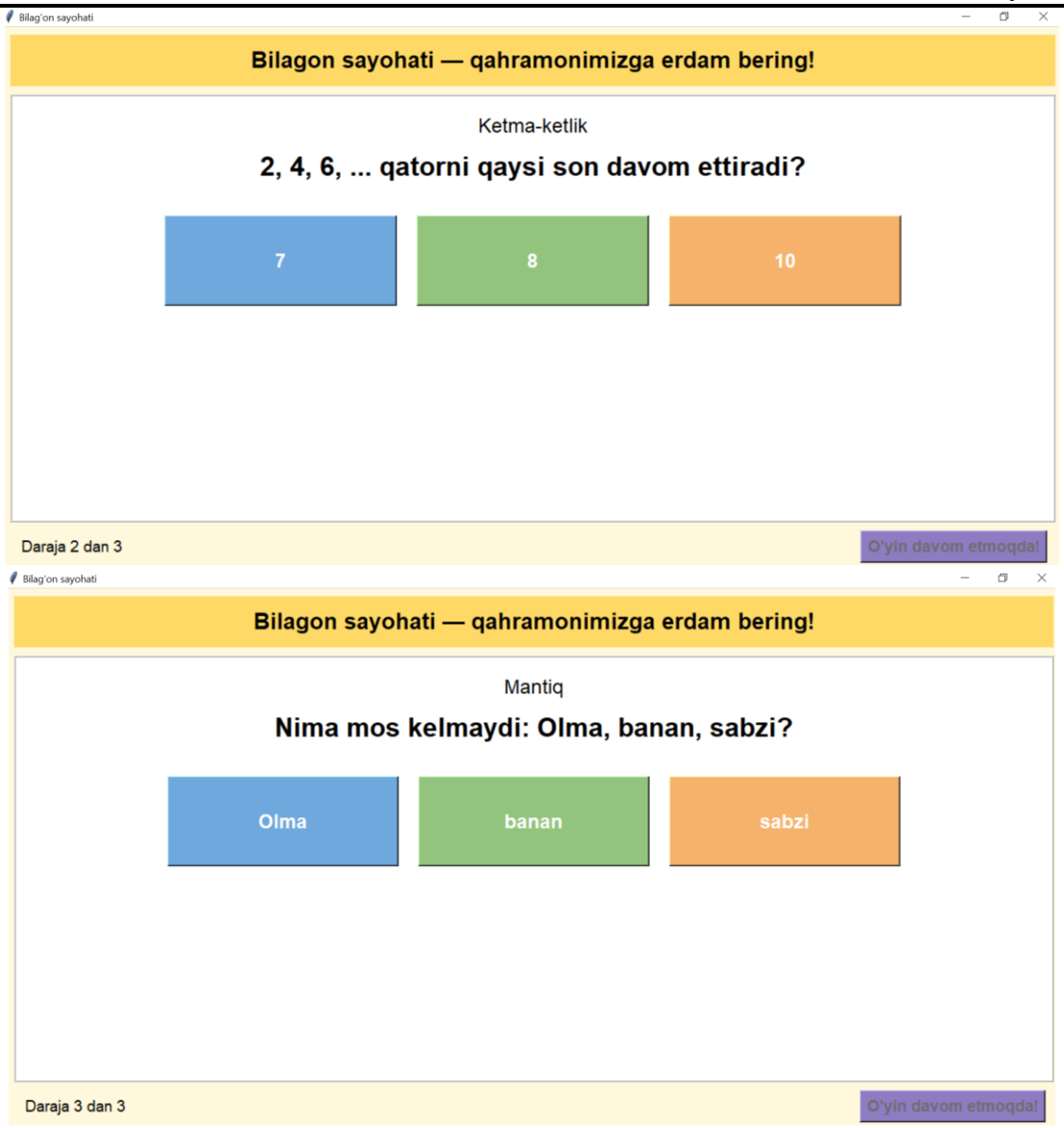

For the Evaluation stage, which is one of the most important stages of the ADDIE model, it is appropriate to consider two aspects separately. The first is to find out the attitude of primary school students to this program, and the second is to determine the educational effectiveness of the program.

1. "Emotional Reflection" questionnaire for students. Considering that text-based questionnaires are difficult for primary school students, it is recommended to use the "Smart-questionnaire", that is, the visual method.

Block of questions (in the program or in paper form):

Interest: "Did you like the game?" (😊 / 😐 / ☹️)

Comprehensibility: "Did you have difficulty understanding the tasks?" (👍 / 👎)

Design: "Did you like the pictures and colors?" (🎨 ⭐ / 🎨 ❌)

Want to play again: “Would you play this game again?” (Yes / No)

2. Control test. To substantiate the impact of the program on logical and creative abilities, it is recommended to conduct tests on the following indicators:

Criteria for determining the level of logical thinking:

Analysis: the ability to group objects according to their common features.

Synthesis: creating a whole from parts (for example, building a building from geometric figures).

Creative approach: finding non-standard solutions to problem situations (for example, “If the pencil breaks, what else can I use to continue drawing?”).

3. “Rating sheet” according to the ADDIE model. Educational results can be analyzed based on the following table:

Evaluation criteria	Indicator	Result verification method
Effectiveness	Increase in the percentage of mastery	Testing and control work
Project quality	Program accuracy	Technical monitoring
Creative activity	Provide new ideas	Observation and interview
Logical consistency	Speed of task completion	Results database

The results obtained can be confirmed not only in percentages, but also using mathematical and statistical methods. For this, we use the Student's t-criterion of statistics. This method allows us to prove that the difference between the experimental class in which the software was used and the control class in which the usual educational activities were carried out is not random.

I. Stages of mathematical and statistical analysis. Suppose we have two classes and 20 students in each of them, then the calculation algorithm will be as follows:

1. Calculation of the average value ($\bar{X}$): we divide the total score of each class in the test control by the number of students.

2. Determination of the variance: it is calculated how far the scores are from the average value (dispersion).

Calculation of the t-criterion: the results shown by the classes are compared using the formula below:

$$t = \frac{|\bar{X}_1 - \bar{X}_2|}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

II. Interpretation of results. The t value obtained from the calculation is compared with the (critical) value in a special statistical table.

- If thisob > ttable, then the created software really increased the logical abilities of elementary school students and this result is not accidental.
- Usually this is written as $p < 0.05$. This means that the level of confidence is 95%.

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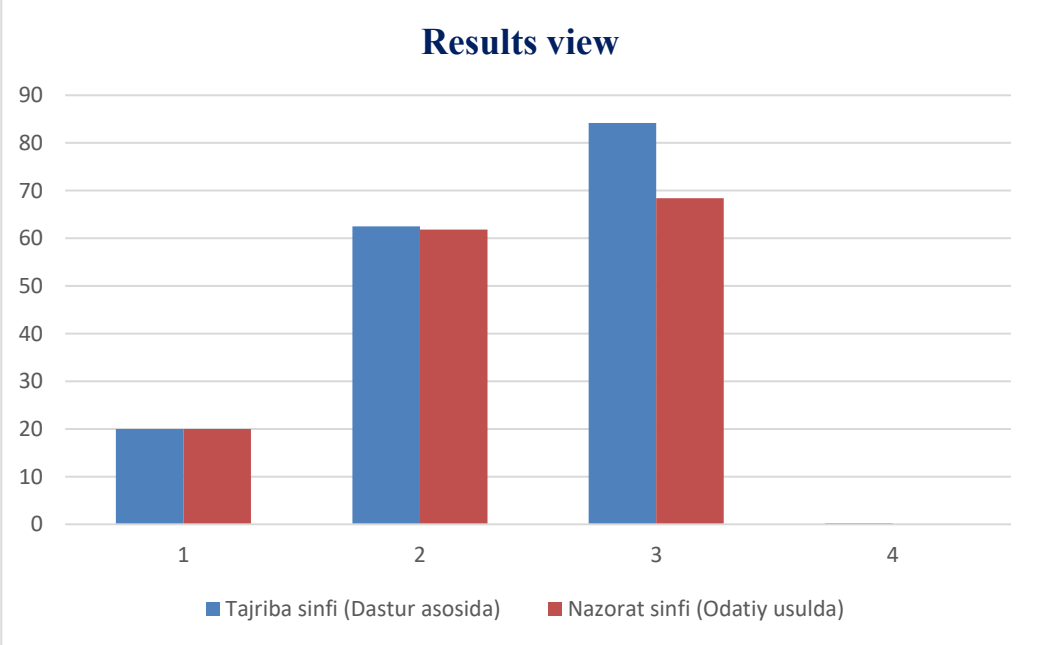
Table of results

Classes	Number of students (n)	Average score (before practice test)	Average score (after practice test)	Growth rate
Experimental class (Based on the program)	20	62,5	84,2	+21,7%
Control group (Usually)	20	61,8	68,4	+6,6%



Conclusion

It was found that the logical thinking indicators in the experimental class were 15.1% higher than in the control class. The value t=2.8 obtained according to the Student criterion confirms the reliability of the results.

- Bloom's taxonomy: a tool for ranking questions and tasks in the program from "simple to complex", from knowledge to creativity.

Bloom's taxonomy is a system that represents the stages of thinking of primary school students, from simple memorization to a high-level creative approach. The use of this system in primary school closely helps in the formation of critical thinking in students. Below we highlight the application of the six stages of Bloom's taxonomy for primary school students through examples:

1. Know (remember). At this stage, the student is required to remember and tell information.
- Keywords: Who? What? When? Count, Tell.
- Example (mathematics): Memorize the multiplication table.
2. Understand. The student is required to be able to express information in his or her own words.
- Keywords: explain, describe, restate.
- Example: Explain the meaning of the operation “Add” with examples.
3. Apply. The student is required to be able to apply the knowledge gained in new situations.
- Keywords: demonstrate, calculate, use.
- Example: perform calculations using monetary units in the example of the “Shopping Game”.
The “Store” game is one of the most effective methods for practicing all stages of Bloom’s taxonomy in elementary mathematics. Through this game, students not only learn to count, but also acquire life skills. Below is how this game can be organized according to the levels of Bloom’s taxonomy:
1. Knowing (remembering). At the beginning of the game, elementary school students remember the names of monetary units and products.
Task: recognize banknotes (for example, 1000, 2000, 5000, 10000, 20000 soums) and say their value.
Question: “How much is this?”, “List 5 products sold in the store.”
2. Understanding. The student understands the concept of price and “purchase”.
Task: explain what the price tag under the product means.
Question: An apple costs 5,000 soums, but if you have two 1,000 soums and one 2,000 soums, can you buy it? Explain your answer.

3. Application. Students immediately begin to perform calculations.
Task: play the roles of a seller and a buyer.
Example: “A student planned to buy a notebook for 2,000 soums and a pen for 1,500 soums. How much money will he have to pay for the purchase in total?” (2,000+1,500=4,500)
4. Analysis. Break the situation into parts and compare.
Task: find the cheapest and most expensive products.
Question: “You have 10,000 soums. You need to buy two different fruits. Which combinations will save you money? Which one will give you the most money back?”
5. Evaluation. Decision-making and justification of the choice.
Task: Assessing thriftiness.
Question: “You have 5,000 soums. You need to buy both a dessert and a diary. But you only have enough money for one of these products. Which one would you buy? Explain and justify your idea.”
6. Creativity. Create a new situation or a new system.
Task: Organize your own store.
Task: “Invent a new product for the store and give it a name and set a price. Prepare an advertising text to sell your product well.”
Equipment needed to organize the game:
- toy money (handmade is also possible).
- products: school supplies, toys or fruit models.
- price lists: pieces of paper with the price written on each item.
Recommendations. In this game, you can further enliven the lesson by dividing students into small groups and electing one to be the “Buyer”, the second to be the “Seller”, and the third to be the “Banker” (money changer or controller). This is the best exercise for students to learn the process of calculating the return on money, that is, the operation of subtraction, during the game.
4. Analysis. Break down the information(s) into parts, identify similarities and differences.
- Keywords: compare, differentiate, find the reason.
- Example: explain the similarities and differences of a triangle and a square.
5. Evaluation. The student expresses his attitude and justifies a certain decision he made.
- Keywords: right? express your opinion! choose, prove.
- Example: by which method is it easier to solve this example and why?
6. Creation (synthesis), this is the highest stage, where the student's creative abilities are formed, that is, he can create new things.
- Keywords: invent, plan, create, come up with.
- Example: using geometric shapes, draw a drawing on the topic “House of the Future”.
Recommendations: during the lesson, it is required not to be limited to questions at the “Knowledge” and “Understanding” levels. Simple questions like “If you were a bunny, how would you run away from a wolf?” (creation) can help develop their thinking skills.

Conclusion

Based on the research and analysis conducted, the following conclusions can be drawn:

- systematic approach: the ADDIE model allows you to move the primary education process from just passing a lesson to a systematic design focused on results. Lessons organized on the basis of this model increase students' ability to concentrate and understand logical sequences.
- creative environment: multimedia and interactive tasks created at the “Development” stage of the model form students' non-standard thinking and creative problem-solving skills.
- effectiveness: Experimental studies have shown that lessons designed based on the ADDIE model have the potential to increase the level of logical thinking of students by 20-25% compared to traditional lessons.
- feedback: the “Evaluation” stage of the model allows the teacher to constantly monitor the quality of education and timely correct shortcomings, which ensures the stability of educational effectiveness in primary grades.

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