Зерттеу жұмыстарының ұсынылатын құрылымы (Action Research)

Ұсынылатын көлем: *2000 сөзден аспауы керек*

Бөлім	**Сипаттамасы**
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Тақырып	**Improving students' self research skills through the Project Based Learning model at Biology lessons in one of Kazakhstani intellectual schools**
Аннотация (150–250 сөз)	Grade 10 students demonstrate insufficient self-research and information analysis skills. They experience difficulties in understanding biological processes at the molecular level and in applying scientific knowledge to real-life situations. In addition, many students struggle to use academic language to explain biological processes logically and coherently. Therefore, there is a need to implement effective teaching approaches that develop research competence and scientific reasoning. Project-Based Learning (PBL) offers strong potential for addressing these challenges. The aim of this research is to improve Grade 10 students' self-research skills through the implementation of the Project-Based Learning model in biology lessons at a Kazakhstani intellectual school. *Methods:* modelling, collect and analyze feedback from teachers and students, Likert-scale responses (to measure perceptions), interviews, rubric-based assessment (for assessing and creating the models) , pre-test/post-test activities (to measure quality of education), CTT-1 analysis to determine the reliability of the test instrument (in tne SPSS program). To address these issues, Lesson Study adopted the 6-stage Project-Based Learning (PjBL) model, which helps students fully understand the theoretical material through a dynamic approach. In the pre-test results, according to Likert scale, the skills of analyzing and giving scientific evidence of the students in the class were 64%, the quality of class knowledge-77%. A,B,C students were selected for focus groups based on the results of unit assessments. Student A's knowledge quality is 86%, on a Likert scale analysis and scientific evidence at level 4. Student B's knowledge quality is 71%, with evidence at level 3. Student C's knowledge quality is 59%, with analysis and proofs at level 2. The practical significance of this research lies in providing an evidence-based approach that enhances research skills, scientific reasoning, and measurable learning outcomes in biology education.
Актуалдылық және мәселенің негізделуі	The study was conducted in Grade 10 in a secondary school aiming to improve academic achievement, research skills, and critical thinking in line with its strategic priorities. The school focuses on developing functional literacy and the ability to apply knowledge in real-life contexts. However, analysis of classroom practice and assessment results revealed key challenges. Students demonstrate low levels of independent research and information analysis skills. They also experience difficulties understanding biological processes at the molecular level, which limits their ability to apply knowledge and justify it scientifically. In addition, many students struggle to use academic language to explain biological processes logically.

	These issues negatively affect learning outcomes and the development of higher-order thinking skills. Therefore, instructional changes are necessary to strengthen inquiry, scientific reasoning, and academic communication, supporting the school's goal of improving educational quality.
Мақсат және зерттеу сұрақтары	*Research Question: How does the Project-Based Learning model foster students' skills to self-investigate biological processes and generate scientific evidence?* Sub-questions: 1. Does applying the PjBL model enhance students' self enquiry skills through simulating complex biological processes with a dynamic model? 2. Does presenting the dynamic model in PjBL instruction enhance students' ability to provide scientific evidence in academic language?
Теориялық негіз (қысқаша)	The key concept underlying this research is Project-Based Learning (PBL), a student-centered teaching approach in which learners acquire knowledge and skills through sustained inquiry into authentic and complex problems. PBL is grounded in constructivist learning theory, which emphasizes active knowledge construction, collaboration, and meaningful engagement with real-world contexts. This study is also based on the concepts of research competence, scientific reasoning, and academic language development. Research competence includes the ability to formulate questions, analyze information, evaluate evidence, and present justified conclusions. Scientific reasoning involves explaining biological processes logically and supporting arguments with evidence. Academic language development ensures that students communicate their understanding clearly and coherently. The chosen approach is professionally justified, as PBL promotes deep content knowledge alongside critical thinking, creativity, collaboration, and communication skills. It aligns with modern educational priorities in secondary science education and supports competency-based learning. Therefore, the implementation of PBL provides a scientifically grounded and pedagogically sound framework for improving students' self-research skills and overall learning outcomes.
Методология	**Modelling:** ➢ Simplifies Complex Systems; ➢ Improves Understanding and Memory; ➢ Demonstrates Processes Over Time; ➢ Supports Hypothesis Testing; ➢ Connects Biology to Real World Problems **Pre-test/post-test activities:** ➢ To Measure Learning Gains; ➢ To Evaluate Teaching Methods; ➢ To Identify Gaps or Misconceptions **Likert-scale responses** ➢ Measure Student Perception; ➢ Quantify Qualitative Feedback; ➢ Evaluate Teaching Methods **Collect and analyze** ➢ To Answer Research Questions; ➢ To Make Informed Conclusions; ➢ To Ensure Objectivity and Accuracy; ➢ To Prove or Disprove Hypotheses; ➢ To Improve Practice or Make Decisions

	Rubric-based assessment ➢ To Ensure Objectivity and Consistency; To Measure Complex Skills or Behaviors; To Provide Transparent Criteria; ➢ To Support Data Collection and Analysis; ➢ To Evaluate the Impact of a Lesson or Intervention **CTT-1 Analysis** in SPSS program to calculate **Cronbach's Alpha**.
Жүзеге асыру (зерттеу барысы)	The study was conducted within the framework of Action Research, following iterative cycles of planning, action, observation, analysis, and reflection. This structure ensured the systematic development of teaching practices and continuous improvement of students' research skills. During the planning stage, it was identified that students demonstrated low levels of analytical thinking, limited ability to justify scientific evidence, and insufficient use of academic language. To address these issues, the 6-stage Project-Based Learning (PjBL) model was introduced. Assessment tools were designed, including rubrics, Likert-scale questionnaires, and pre-test instruments. Clear success criteria and project requirements were established collaboratively with students. At the action stage, students began working on research projects following the structured Design Map. The teacher acted as a facilitator and consultant, guiding students in selecting resources and organizing information. Practical components were integrated to support theoretical understanding. Observation was carried out through classroom monitoring, analysis of student discussions, formative assessment, and feedback collection. Particular attention was paid to students' ability to analyze data and provide scientific justification. The analysis of the first cycle revealed moderate improvement in engagement and collaboration; however, some students still experienced difficulties in structuring arguments and applying molecular-level concepts. During reflection, it was concluded that additional scaffolding was required, particularly in developing academic language and evidence-based reasoning. Based on the reflections from the first cycle, adjustments were implemented. Additional modelling sessions, structured templates for scientific explanations, and targeted feedback strategies were introduced. Greater emphasis was placed on peer assessment and guided questioning techniques. The next cycle demonstrated improved clarity in students' explanations, stronger justification of scientific claims, and increased independence in conducting research. Post-test results and rubric-based assessments indicated measurable progress in analytical skills and knowledge quality. Thus, each research cycle informed subsequent actions, ensuring a dynamic and responsive process of pedagogical improvement. The iterative nature of Action Research allowed for continuous refinement of instructional strategies and systematic enhancement of students' self-research competence.
Нәтижелер және негізгі қорытындылар	Likert-scale responses and observations: 13% improvement in self research and thematic analysis skills compared to the Pre-test scores. Post-test on Likert-scale results: boys' interest in research and analytical skills is 4% higher than girls'. Teachers' observations of students creating dynamic models, along with rubric-based assessment, revealed growth in the level of self-investigation. Post-test resuts: A - level 5, B - level 4, C - levels between 2-3. Unit and Summative assessment: 6.5% increase in critical thinking skills compared to the pre-test student A's knowledge quality has improved from 86% to 92%, student B's result from 71% to 75%, student C's result from 59%

	to 65%. As a result of the CTT-1 analysis of the test developed on the topic "Mitosis and Meiosis Processes," the Cronbach's Alpha value was *0.88,* indicating that the test is highly reliable. Most of the questions have optimal difficulty and good discriminative ability, making the test suitable for effectively assessing students' critical thinking and analytical skills.
Практикалық ұсыныстар	It is recommended that at least one unit per quarter in the biology curriculum be conducted using the six-stage Project-Based Learning (PjBL) model. Integrating project-based activities enhances student engagement, develops research skills, and allows differentiated tasks for A, B, and C level students, ensuring inclusive participation and targeted support. The study also confirmed PjBL's effectiveness in interdisciplinary STEM projects involving students of different ages. Platforms for professional exchange such as open lessons, coaching sessions, and online seminars can support dissemination of best practices among educators. Future research will focus on longitudinal monitoring of students' analytical and reasoning skills, exploring the relationship between academic achievement and creative thinking, and expanding the study to include parallel classes for comparative analysis of interdisciplinary PjBL. The findings demonstrate that the integrated project-based approach improves knowledge quality, analytical skills, and reasoning across performance levels. Level differentiation, systematic resource selection, and creative modelling were key factors. Overall, the approach strengthens theoretical understanding, practical competence, and sustained interest in biology. In 2025, the research results were presented at the Republican Competition of Pedagogical Ideas and won 2nd place, confirming its practical significance.
Қорытынды	The study showed that using dynamic models within Project-Based Learning (PjBL) effectively enhanced students' research and critical thinking skills in biology. Students demonstrated stronger abilities in independent enquiry and in identifying cause-effect relationships in biological processes. Teachers observed noticeable growth in students' self-investigation and scientific reasoning during group work and model creation. Both students and teachers noted that this approach made learning more engaging and meaningful. As a result of the CTT-1 analysis of the test developed on the topic "Mitosis and Meiosis Processes," the Cronbach's Alpha value was 0.88, indicating that the test is highly reliable. Most of the questions have optimal difficulty and good discriminative ability, making the test suitable for effectively assessing students' critical thinking and analytical skills. Overall, the use of dynamic modeling proved to be an effective method for deepening understanding and improving the quality of learning in biological education.
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Берілген тараудың келесідей оқу мақсаттары ұсынылады:
10.2.2.1 жасушалық айналымның интерфазасында болатын үдерістерді түсіндіру;
10.2.2.2 митоздың кезеңдерін сипаттау;
10.2.2.5 митоз және мейоз үрдістерін салыстыру.

1. Жасушалық айналымның интерфазасында болатын үдерістерді түсіндіру
- жасушалық айналымды түсіндіреді;
- жасушалық айналым кезеңдерін және реттелуін атайды;
- жасушалық айналымның маңызын түсіндіреді.

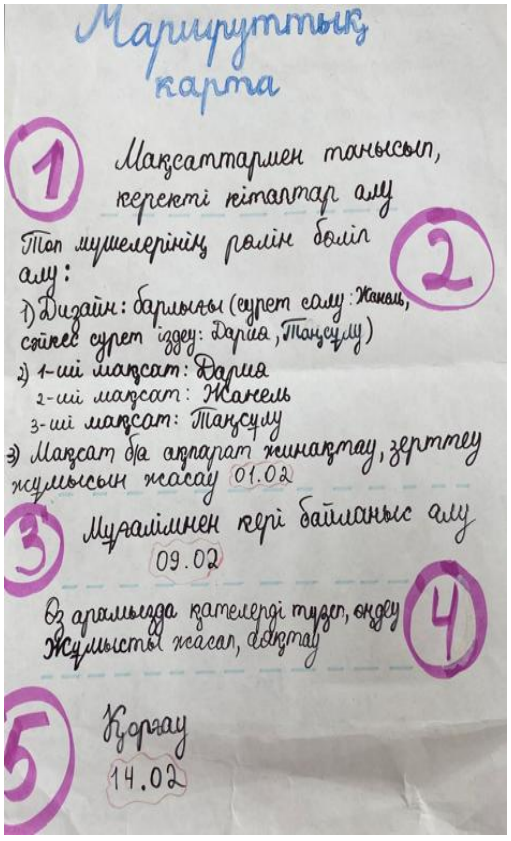
2. Митоздың кезеңдерін сипаттау;
-Митоз жүретін жасушаларды атайды;
- Митоз кезеңдерін сипаттайды;
- Митоздың маңызын түсіндіреді
- Митоздың жүруіне әсер ететін жағдайларды талдайды.

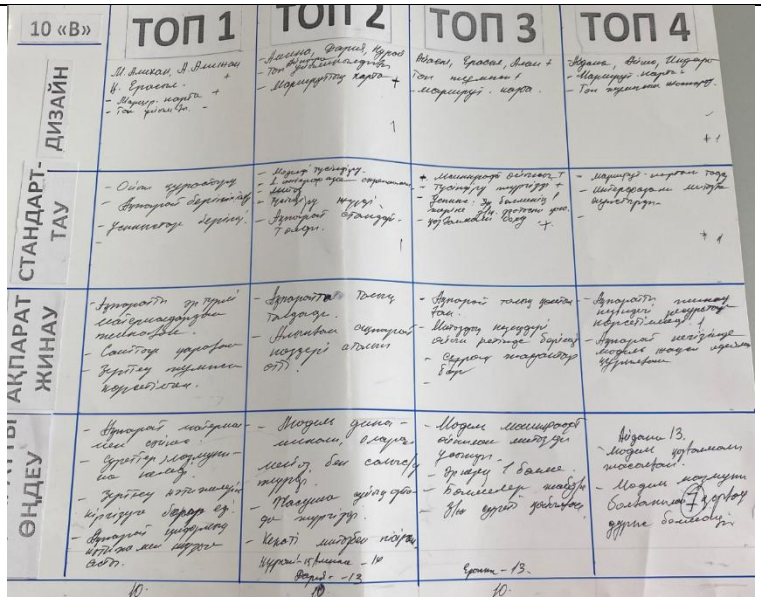
❖ **Тапсырманы топта орындау қажет!**

Бағалау критерийлері:

Критерийлер	**Дескрипторлар**	**Балл**
Дизайн және топтық жұмыс	Топ мүшелерінің рөлін бөліп алуы	**ЕСКЕРТУ!** Топтағы осы критерийлердің барлығы сақталған жағдайда ғана балл беріледі. **1**
	Топтағы ұйымшылдық	
	Топтық жұмыста қолданатын ресурстарды толық таныстырды	
	Бір аптадағы жұмыс жоспары	
Стандарттау	Мұғіммен кездесу күндерін белгілеу	**1**
	Ақпараттарды жинақтап, талдауға, кері байланысқа ұсыну	
	Мазмұны бойынша оқушының жинақтаған ақпаратын сипаттауы	
Ақпараттарды жинақтау	Мазмұны мен суреттерінің сәйкестігі	**2**
	Мазмұны мен модельдің сәйкестігі	
	Ақпараттың толық болуы жайлы кері байланыс алу	
Ақпараттарды өңдеу	Мұғалімнің қалыптастырушы бағалауы	1
	Мұғалімнің жиынтық бағалауы	1
Қорғау	Ақпараттарды жеткізе алуы	1
	Өнім: жаңашыл идеямен жасалған **немесе** цифрлық заманауи программалар қолданылған қозғалмалы модель	1
	Берілген ақпарат анализ жасалған митоз кезеңдері бір-бірімен салыстырмалы түрде болуы	1
	Митоз бен мейоздың айырмашылығын салыстырмалы түрде көрсетуі	1
	Жалпы балл	**10**

Қосымшалар (қажет болса)





Results of research work: