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13.00.00 Pedagogika fanlari
13.00.01 Pedagogika nazariyasi. Pedagogik ta'limotlar tarixi
13.00.02 Ta'lim va tarbiya nazariyasi va metodikasi (sohalar bo'yicha)
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MUNDARIJA

GAMIFIED PROGRAMMING PLATFORMS: ANALYSIS AND RECOMMENDATIONS

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Abstract: In the context of contemporary globalization, the demand for acquiring modern professions is steadily increasing. Programming is widely recognized as a complex cognitive activity; however, learning it through gamified technologies makes the process both engaging and pedagogically effective. Gamified programming platforms enhance motivation by integrating game elements such as levels, points, badges, and interactive challenges into the learning process. This article analyzes and compares five popular platforms – CodeCombat, CodinGame, Tynker, Scratch, and Blockly Games. Each platform demonstrates distinctive characteristics: CodeCombat teaches programming in an RPG format with real-time feedback; CodinGame supports global competition and multiple programming languages; Tynker integrates block-based and text-based coding to facilitate creative project development; Scratch enables the creation of interactive stories and games through visual programming; and Blockly Games fosters mathematical and logical thinking skills. The analysis indicates that Scratch and Blockly Games are most suitable for young learners; CodeCombat is effective for beginners; while adolescents and adults can benefit from CodinGame's competitive and multilingual environment. Tynker is particularly appropriate for schools and structured curricula. Furthermore, advanced learners are recommended to transition from block-based platforms to text-based programming languages. The article highlights the advantages and limitations of gamified platforms and provides practical recommendations for effective programming education.

Key words: gamified learning, programming platforms, CodeCombat, CodinGame, Tynker, Scratch, Blockly Games, educational technology.

Annotatsiya: Mazkur maqola umumta'lim maktablarida dasturlashni o'qitish masalasiga oid mavjud ilmiy tadqiqotlarni kompleks va tizimli ravishda tahlil qilishga qaratilgan. Tadqiqotda sifatli kontent tahlili metodologiyasi asosida dasturlash mashg'ulotlarini rejalashtirish, loyihalash va samarali tashkil etishning pedagogik yondashuvlari aniqlashtiriladi hamda tizimlashtiriladi. Tahlil natijalari shuni ko'rsatadiki, so'nggi yillarda umumta'lim darajasida dasturlash ta'limiga bag'ishlangan ilmiy ishlar soni sezilarli darajada oshgan bo'lib, ularning asosiy qismi empirik tadqiqot dizayniga asoslangan. Mavjud izlanishlarning katta qismi 6-sinf o'quvchilari bilan olib borilgan bo'lib, ma'lumot to'plash jarayonida asosan anketalar, so'rovnomalar va standartlashtirilgan testlardan foydalanilgan. Dasturlash vositalari tahlili Scratch platformasining eng keng tarqalgan o'quv muhiti ekanligini ko'rsatadi, bu esa vizual va blokli dasturlash yondashuvlarining maktab yoshidagi o'quvchilar uchun metodik jihatdan maqbulligini tasdiqlaydi. Shu bilan birga, dasturlash darslarining kontekstual va fanlararo integratsion jihatlarini o'rganuvchi tadqiqotlar nisbatan cheklanganligi aniqlandi. Ayrim ilmiy ishlarda dasturlash matematika, tabiiy fanlar, tillar, yozma nutq va ijtimoiy fanlarni o'qitishda vositaviy metod sifatida qo'llanilgan bo'lsa-da, bu yo'nalish hali yetarlicha tizimlashtirilmagan. Umuman olganda, mazkur tadqiqot dasturlash ta'limining zamonaviy holatini konseptual jihatdan umumlashtirib, metodik yondashuvlarni integratsiyalash hamda kelgusida kompleks va uzoq muddatli empirik tadqiqotlar o'tkazish zaruratini asoslaydi.

Kalit so'zlar: dasturlash savodxonligi, sifatli kontent tahlili, pedagogik yondashuvlar, fanlararo integratsiya, Scratch dasturlash muhiti, empirik tadqiqot, metodik tizimlashtirish (shu tartibda rus va ingliz tilida).

Аннотация: Данная статья направлена на комплексный и системный анализ существующих научных исследований, посвящённых обучению программированию в общеобразовательных школах. На основе методологии качественного контент-анализа уточняются и систематизируются педагогические подходы к планированию, проектированию и эффективной организации учебных занятий по программированию. Результаты анализа свидетельствуют о значительном росте числа исследований в области программного образования на уровне общего среднего образования в последние годы; при этом большинство работ основано на эмпирическом исследовательском дизайне. Значительная часть существующих исследований проведена с участием учащихся шестых классов, а в качестве инструментов сбора данных преимущественно использовались анкеты, опросники и стандартизированные тесты. Анализ используемых средств обучения показал, что платформа Scratch является наиболее распространённой образовательной средой, что подтверждает методическую целесообразность применения визуального и блочного программирования для школьников. Вместе с тем установлено, что исследования, посвящённые контекстуальным и междисциплинарным аспектам уроков программирования, представлены в ограниченном объёме. В ряде работ программирование рассматривается как инструмент обучения математике, естественным наукам, языкам, письменной речи и социальным дисциплинам; однако данное направление пока недостаточно систематизировано. В целом исследование концептуально обобщает современное состояние программного образования и обосновывает необходимость интеграции методических подходов, а также проведения комплексных и долгосрочных эмпирических исследований в данной области.

Ключевые слова: программная грамотность, качественный контент-анализ, педагогические подходы, межпредметная интеграция, среда программирования Scratch, эмпирическое исследование, методическая систематизация.

INTRODUCTION

Programming can be challenging for beginners taking their first steps in the field. Gamified platforms transform this complex learning process into an engaging experience by incorporating game elements such as points, levels, badges, and interactive challenges. These elements enhance motivation and foster sustained engagement while simultaneously developing knowledge and practical skills.

This article aims to provide guidance for students who are interested in programming but are uncertain about where to begin. The study analyzes five widely used gamified programming platforms: CodeCombat, CodinGame, Tynker, Scratch, and Blockly Games.

ANALYSIS AND RESULTS

CodeCombat. CodeCombat is an RPG-style (Role-Playing Game) programming platform. In RPG environments, users control a character, make decisions, complete missions, and interact within a structured narrative world. Typically, RPG systems include levels, rewards, inventory systems, and story-based progression. In CodeCombat, users write code to control their character's actions, defeat enemies, and complete missions. Through gameplay, learners develop algorithmic thinking, logical reasoning, and fundamental programming skills. The platform supports Python and JavaScript. Code execution occurs in real time, and users receive immediate feedback regarding errors and corrections. CodeCombat follows a structured progression from beginner to advanced levels, and its user-friendly interface enhances accessibility (Figure 1).

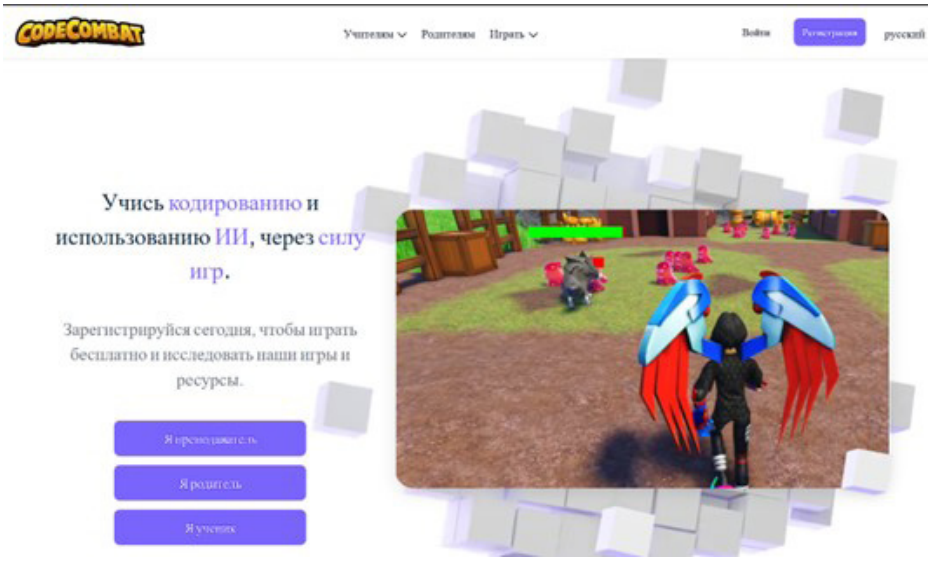

Figure 1.

CodinGame. CodinGame is a gamified programming platform characterized by its competitive environment. Users solve algorithmic challenges, artificial intelligence problems, and logic-based tasks through coding (Figure 2).

Figure 2.

A distinguishing feature of CodinGame is its strong leaderboard and competitive programming system. The platform supports more than 25 programming languages, including Python, Java, C++, JavaScript, C#, Go, and Kotlin. CodinGame primarily develops algorithmic thinking, problem-solving skills, and optimization strategies. It is particularly suitable for learners preparing for technical interviews or competitive programming contests (Figure 3).

Figure 3.

Tynker. Tynker is a gamified programming platform designed primarily for children and beginners. It integrates interactive storytelling, creative projects, and structured curricula into the learning process. While mainly intended for learners aged 5–17, it can also benefit adult beginners. Tynker provides two coding approaches. Block-based coding, similar to Scratch, which prevents syntax errors and simplifies foundational learning. Text-based coding, including Python, JavaScript, and HTML/CSS, enabling a gradual transition to real-world programming. The platform incorporates gamification elements such as points, badges, levels, and interactive missions. Learners can create games, animations, Minecraft modifications, stories, and even program robots and drones. Tynker integrates programming with mathematics, engineering, and problem-solving skills within a STEAM-oriented framework (Figure 4).

Figure 4.

Scratch. Scratch, developed by the MIT Media Lab, is a visual programming platform designed for children and beginners. It is available both online and offline and is free of charge. Scratch uses a drag-and-drop, block-based coding system, eliminating syntax errors and enabling learners to visually understand programming structures such as loops, conditionals, variables, and functions. One of Scratch's strongest features is its global online community, where users can share projects, explore others' work, and remix existing projects. Scratch is widely implemented in school curricula worldwide and significantly contributes to the development of creativity, algorithmic thinking, and collaborative learning. However, while Scratch is highly effective at the introductory level, transitioning to text-based programming languages becomes necessary for professional advancement (Figure 5). Figure 5

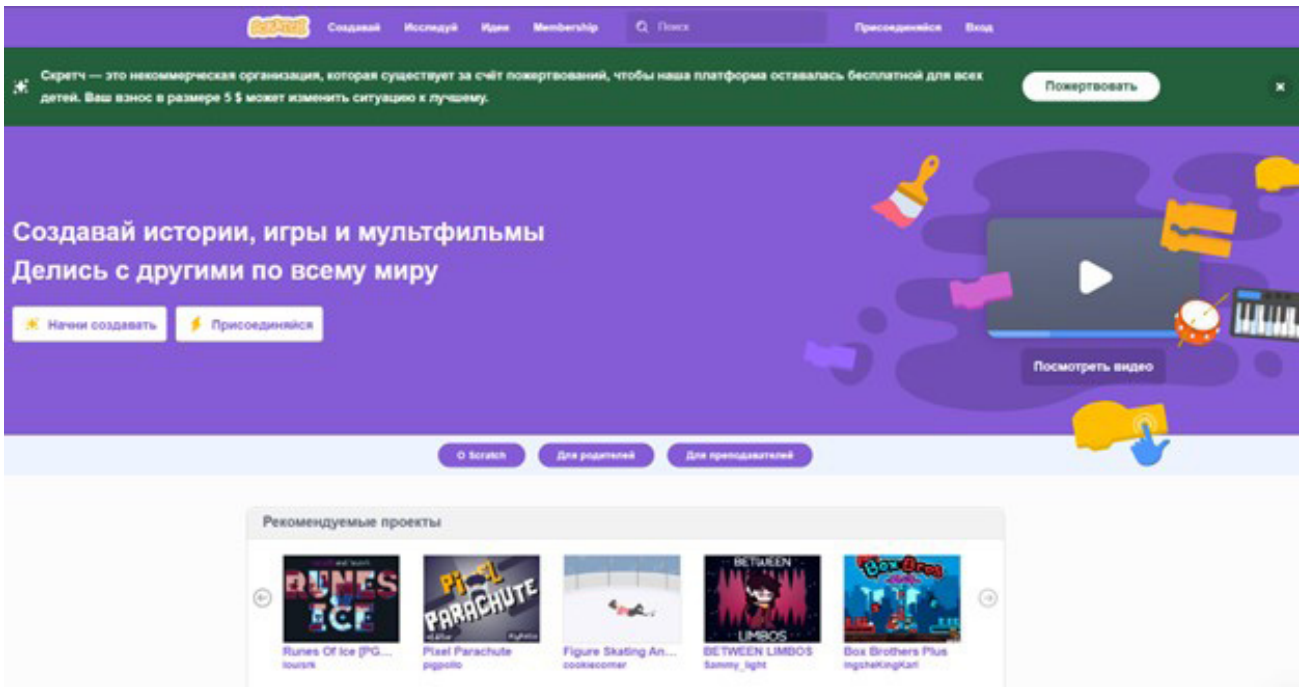

Figure 5.

5. Blockly Games. Blockly Games, developed by Google, is a free and open-source educational platform designed to teach programming fundamentals through block-based coding. The platform introduces programming concepts progressively through thematic games such as Puzzle, Maze, Bird, Turtle, Movie, Music, and Pond. These games guide learners from simple logical sequencing to more advanced JavaScript-based problem-solving tasks. A key advantage of Blockly Games is that, at advanced stages, the system automatically displays the equivalent JavaScript code generated from block-based solutions. This feature facilitates a smooth transition from visual programming to text-based coding. Blockly Games is particularly effective in developing logical reasoning and mathematical thinking skills among young learners (Figure 5).

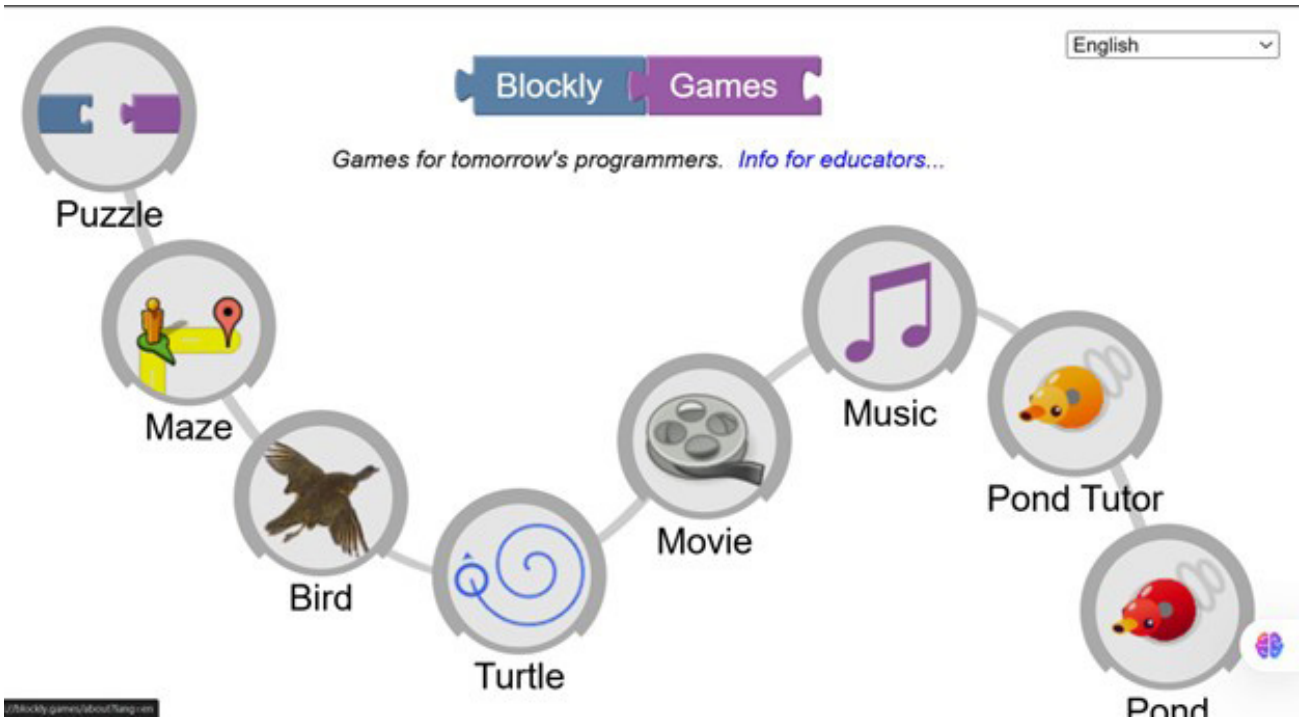

Figure 5.

Table 1: **Comparative analysis**

№	Platform	Target Age/Level	Programming Language(s)	Advantages	Limitations
1	**CodeCombat**	Beginner/Intermediate	Python, JS	RPG format, real-time feedback	Some paid levels, may be difficult for absolute beginners
2	**CodinGame**	Teens/Adults	25+ languages	Competitive environment, multilingual	Complex for young learners
3	**Tynker**	Children/Beginners	JS, Python, HTML/CSS	Creative projects, structured learning	Mostly subscription-based
4	**Scratch**	Children/Beginners	Block-based	Creative, strong community	Not suitable for professional coding
5	**Blockly Games**	Children/Beginners	Block-based	Free, logical development	Limited for advanced learners

Recommendations for the effective use of gamified programming platforms. Selection According to Age and Level of Preparedness. When selecting a platform, the learner's age and prior programming knowledge must be carefully considered. For children aged 6-10, Scratch and Blockly Games are appropriate due to their visual and intuitive interfaces. For learners aged 10-14, Tynker and Scratch (with more complex project development) are suitable. For beginner adolescents, CodeCombat is effective, while learners at the algorithmic development stage are better suited to CodinGame. Gradually increasing the complexity of learning tasks leads to more effective and sustainable outcomes. Transition Model from Block-Based to Text-Based Coding. For effective instruction, the following sequence is recommended: Blockly Games → Scratch → Tynker (block-based + text-based) → CodeCombat (Python/JavaScript) → CodinGame (advanced algorithmic practice). This structured progression reduces cognitive load and helps prevent syntax-related errors during the early stages of learning. Strengthening the Learning Process Through Gamification Elements. Gamification elements should be purposefully integrated into the instructional process: using points and badge systems as motivational rewards; organizing mini-competitions; conducting project presentations among learners; utilizing leaderboards as motivational tools. These methods contribute to the development of intrinsic motivation and sustained engagement. Maintaining a Balance Between Theory and Practice. The use of platforms should not be limited solely to gameplay. The following pedagogical strategies are recommended: Discussing concepts after completing each task; Designing algorithms on paper before implementation; Practicing code optimization exercises; Developing small real-life-related projects. Such integration ensures deeper conceptual understanding and practical competence.

Recommendations for Schools and Educational Centers. Scratch and Tynker can serve as primary platforms in primary education. CodeCombat is effective in middle grades for developing algorithmic thinking. CodinGame is recommended for upper-grade students and learners specializing in IT. Teachers should implement monitoring and progress-tracking systems to evaluate learner development. Individual Learning Strategy. For independent learners, it is advisable to set weekly learning goals and complete at least a minimum level on each platform. Creating small independent projects based on newly acquired knowledge reinforces learning outcomes. After gaining sufficient confidence, learners may gradually transition to text-based programming languages. Long-Term Development Strategy. Gamified platforms are highly effective at the introductory stage of programming education. However, for professional growth, learners should additionally: Work with GitHub repositories; Develop real-world projects; Study frameworks and programming libraries; Practice competitive programming. Such steps ensure sustainable skill development and readiness for professional IT environments.

CONCLUSION

Gamified programming platforms represent an innovative and effective approach to programming education. The analysis of CodeCombat, CodinGame, Tynker, Scratch, and Blockly Games demonstrates that these platforms provide adaptable learning environments suitable for diverse age groups and skill levels. Block-based platforms such as Scratch and Blockly Games are particularly effective at the introductory stage, whereas platforms incorporating text-based programming, such as CodeCombat and Tynker, prepare learners

for real-world coding environments. CodinGame further enhances algorithmic thinking through competitive engagement. In conclusion, the systematic and goal-oriented integration of gamified platforms significantly improves programming learning outcomes and establishes a strong foundation for future professional IT competencies.

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