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보상 기반 학습 생태계를 통한 교육 형평성의 재구성: AI·블록체인 기술 기반 접근의 적용 가능성 연구

(Reconstructing Educational Equity through Incentive-Based Learning Ecosystems: A Study on the Applicability of AI- and Blockchain-Based Approaches)

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Abstract

In the 21st century, education is no longer considered a privilege specific to certain nations or social strata but is recognized as a universal right that all humanity should be guaranteed. However, in reality, severe **Educational Inequality** persists across the globe, leading not only to disparities in academic achievement but also to social stratification, the entrenchment of poverty, and widening gaps in national competitiveness. Particularly in low-income countries, conflict zones, and areas with limited digital access, a significant number of children and adolescents still lack basic literacy skills, and existing public education policies or remote learning infrastructures alone prove insufficient to fundamentally resolve this issue.

This paper seeks to approach this problem of educational inequality from a novel perspective. Specifically, it explores the potential of a **Reward-Based Learning Model** that integrates three core elements: learning, experience, and reward. Furthermore, it analyzes the extent to which a digital platform based on this model can contribute to bridging the global educational divide. As a concrete case study, this research presents the planned implementation of **NodajiFi**, a reward-based learning platform designed to provide learners with autonomy and sustainability through AI-driven personalized learning recommendations, a transparent reward system based on blockchain technology, and immersive learning environments utilizing Metaverse and VR technologies.

The research methodology employed a combination of literature review, based on reports from major international organizations such as UNESCO, the World Bank, and UNICEF, and an analysis of actual operational cases of technology-based learning platforms. Through this combined approach, the study aims to propose a more integrated and sustainable solution to the complex problem of educational inequality,

which is intertwined with multiple factors, including the digital divide, socioeconomic determinants, and regional disparities in educational access.

Consequently, this paper demonstrates that the Reward-Based Learning Model, going beyond mere technological adoption, can offer effective educational opportunities, especially to educationally marginalized groups, through a structure that motivates learning, encourages sustained participation, provides immersive learning experiences via experimentation, and ensures fair and transparent performance rewards. Moreover, it suggests that such a system could serve as a structural turning point for mitigating global educational inequality in the medium to long term, rather than merely being a short-term intervention.

Keywords: Educational Inequality, Reward-Based Learning, Digital Education Platform, Artificial Intelligence (AI), Blockchain, Experiential Learning, Digital Equity, Immersive Education, Global Education Gap, NodajiFi.

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1. Introduction

1.1 Research Background and Objectives

Despite education being a fundamental human right and a core element of sustainable development, severe educational inequality continues globally. According to the latest statistics from UNESCO, as of 2023, the number of children and adolescents out of school reached 250 million, indicating that progress in educational provisioning has stagnated over the past several years. Concerns are being raised that achieving the international community's common goal of providing quality primary and secondary education to all children by 2030 (Sustainable Development Goal 4, SDG 4) will be difficult unless urgent action is taken, particularly as children in low-income countries or vulnerable regions are being deprived of quality education.

Educational disparities have lifelong consequences for individuals' quality of life and income opportunities, and on a broader societal level, they lead to the intergenerational transmission of poverty and stagnation in economic development. Therefore, seeking effective solutions to alleviate global educational inequality has emerged as a universal imperative for all humanity.

1.2 Scope and Methodology of the Study

The objective of this study is to comprehensively review the aspects and causes of global educational inequality and to explore novel solutions that integrate cutting-edge technology with reward systems. To achieve this, we will analyze preceding research and statistical data on educational gaps through a literature review method and identify practically applicable strategies through case studies of select nations and international organizations.

This study particularly focuses on the potential for enhanced educational accessibility due to advancements in digital technology and how a conceptual approach utilizing a learner-reward-based learning platform can contribute to mitigating educational inequality. The research methodology involved conducting a literature analysis of reports from international organizations, academic papers, and statistical

data, alongside a comparative review of educational projects utilizing technological elements such as Artificial Intelligence (AI), Blockchain, and the Metaverse.

1.3 Overview of the Paper's Structure

This paper is organized into six chapters. First, Chapter 2 defines the concept of global educational inequality and analyzes its main causes from economic, social, and technological perspectives. It also reviews existing prior research concerning traditional approaches such as Official Development Assistance (ODA), issues related to the digital education divide, and theories and cases involving learning rewards. Chapter 3 presents the current status of global educational inequality across different regions (developed vs. developing countries, Africa, South Asia, Latin America, etc.) and specifically analyzes the core factors driving educational gaps (digital accessibility, socioeconomic, and cultural factors).

Chapter 4 analyzes existing cases regarding the reward system for motivating learning and the utilization of digital platform systems within reward-based learning and experiential platforms. Chapter 5 presents the core proposal of this paper: solutions for alleviating educational inequality through the NodajiFi reward-based learning and experience platform, which is currently scheduled for service launch. This section covers the design of the reward system to induce learning motivation, methods for utilizing the digital platform and technologies (e.g., AI-driven personalized learning, blockchain-based reward systems), the utilization of immersive virtual learning environments (Metaverse, VR/AR), and the Public-Private Partnership (PPP) and international organization linkage models necessary for the diffusion of these initiatives. Finally, Chapter 6, the Conclusion, summarizes the research findings, evaluates the significance and limitations of the technology-centric approach, and derives policy and practical implications. Through this, the study aims to provide insights for future educational policy formulation and international cooperation directions.

Chapter 2. Background and Conceptual Analysis

2.1 Conceptual Understanding of Global Educational Inequality

Global educational inequality refers to the disparity in educational opportunities and outcomes between nations or between different groups within a single nation. This is observable across various indicators such as school enrollment rates, completion rates for primary to tertiary education, academic achievement scores, student-to-class ratios, student-to-teacher ratios, and the amount of educational investment. For instance, in some underdeveloped countries, a majority of children do not even receive primary education, whereas in developed nations, tertiary education has become universal. These disparities stem from numerous factors, including economic status, region (urban vs. rural), household income and parental education level, gender, race/ethnicity, language, and the presence or absence of disabilities. Educational inequality is recognized as a serious problem not just because it represents statistical variance, but because it results in inequality of opportunity and social unfairness, thereby reinforcing the intergenerational cycle of poverty. Poverty, in particular, is identified as the most fundamental cause of educational inequality; according to the UNESCO Global Education Monitoring Report, poverty acts as a greater barrier to educational access than any other factor. Children from poorer backgrounds often have to forgo education due to the burden of supplies, tuition fees, or the necessity of child labor, which subsequently leads to income disparities and deepens overall societal inequality.

To understand the concept of educational inequality, it can be examined across three dimensions: economic factors, sociocultural factors, and technological factors. Economic factors, as mentioned, include the gap in educational investment and the continuation of schooling due to differences in national and household income levels. Sociocultural factors encompass gender-based discrimination (limiting educational opportunities for girls), discrimination against specific minority or immigrant groups, educational disruption due to cultural customs (such as early marriage practices), or political instability and conflict. Technological factors refer to the new form of educational

gap arising from unequal access to Information and Communication Technologies (ICT), i.e., the digital divide. As much educational content and opportunity have shifted online in the 21st century, those lacking access to the internet and digital devices face additional disadvantages. Considering these multiple aspects, educational inequality must be understood as a multidimensional and complex phenomenon, necessitating an integrated approach to its resolution.

2.2 Review of Previous Studies

The international community has long exerted diverse efforts to mitigate global educational inequality. Official Development Assistance (ODA) is a representative traditional approach, wherein developed countries and international organizations provide educational funding to developing nations to build schools, train teachers, and deliver educational programs. According to the OECD, although the scale of ODA invested in education has steadily increased, it remains insufficient relative to the demand, and there is a recognized need for greater focus on basic education in low-income countries. Reports from organizations like Oxfam recommend that wealthy nations allocate at least 0.7% of their GDP to the education sector as ODA for closing educational gaps, emphasizing that funding should prioritize basic education in the Least Developed Countries (LDCs) to help their governments establish public education systems.

Furthermore, within individual nations, policies have been researched to expand support for vulnerable populations through the equitable distribution of educational resources and the strengthening of compulsory education systems. For example, in social policy, the introduction of Conditional Cash Transfer (CCT) programs, which provide cash assistance to children from poor families if they attend school, has been reported to significantly increase school attendance rates in countries like Brazil and Mexico. While such traditional approaches that lower economic barriers have contributed to improving educational access to some extent, the continued presence of many children outside of school necessitates more innovative complementary measures.

Meanwhile, research focusing on the digital education divide is also active. Since the 2000s, the advent of e-learning utilizing the internet and computers, OpenCourseWare, and Massive Open Online Courses (MOOCs) has enabled the global sharing of educational resources; however, this digital revolution has been pointed out for creating a new form of gap between those who benefit and those who do not. For instance, learning enhancement through AI tutors and online courses has become a reality in areas like California and South Korea, yet millions of children in low-income countries are still studying in adverse conditions without even internet connectivity.

A joint report by the ITU and UNICEF found that approximately 1.3 billion school-aged children and adolescents worldwide—two-thirds of the total—lack in-home internet access, and this lack of digital accessibility is creating a new class of the educationally excluded. Consequently, international organizations are currently focusing on school internet connection projects (e.g., the GIGA Initiative) or the distribution of educational technology, striving to improve digital device and access environments in collaboration with governments and corporations. This discourse is expanding beyond the mere distribution of technology to encompass innovation in pedagogical methods utilizing technology and strategies for motivating learning.

Theories of learning synchronization and reward-based learning are also gaining attention in the context of bridging educational gaps. Psychologically, learner motivation is a decisive factor for learning continuity and achievement, and external support, encouragement, and reward systems can play a crucial role in enhancing motivation, especially for learners in difficult circumstances. B.F. Skinner’s theory of operant conditioning, a classic theory in behaviorist psychology, posits that appropriate rewards for a behavior increase the probability of that behavior's repetition, and reward practices—such as giving prizes for top academic performers or for perfect attendance—have been utilized in educational settings.

Following the 2010s, research on gamification, the integration of digital game elements into education, has advanced. Strategies that link reward elements like points, badges, and leaderboards to learning tasks have gained prominence for increasing

learner interest and participation. Several experimental studies demonstrate that gamification techniques can positively influence learning outcomes. For example, one study introducing levels, badges, and feedback systems into an online learning platform resulted in the task completion rate of students increasing by more than three times, from an initial 18.5% to 56.3%. Another case reported that motivation increased by over 40% and boredom significantly decreased when gamification was applied.

It is important to note, however, that the Self-Determination Theory warns that excessive extrinsic rewards can undermine intrinsic motivation, meaning the effects may vary depending on the type and method of reward application. Nevertheless, substantial evidence has accumulated demonstrating that appropriate reward design can enhance learning participation and persistence, which has significant implications for educational gap alleviation strategies. It is anticipated that providing small yet immediate reward systems to vulnerable students—who have low learning motivation or a high risk of dropping out due to harsh environments—can increase educational participation rates.

Furthermore, a recent meta-analysis by Ritchie & Tucker-Drob (2018) reported that education has a substantial impact not only on knowledge acquisition but also on cognitive ability, specifically intelligence. This study synthesized data from various countries to empirically demonstrate that expanding educational opportunities contributes to increasing the overall intellectual capital (human capital) of a society. Therefore, resolving educational inequality can be interpreted as a structural turning point that enhances the capabilities of individuals and society as a whole, beyond mere ethical or welfare considerations.

2.3 Approach Based on Learning and Reward

Synthesizing the theories examined above, the learning and reward-based approach can be defined as a strategy that stimulates learning motivation and promotes continuous participation by providing explicit rewards (such as certifications, points, or monetary benefits) when learners engage in the educational process and achieve accomplishments. The fundamental principle of this approach is summarized by the concept of “Learn & Earn,” meaning that learning directly leads to rewards. It is

designed so that when a learner completes a certain learning activity, they receive a corresponding reward, linking the learning activity itself to economic and psychological benefits. Traditionally, rewards for education were delivered with long delays in the form of diplomas or transcripts, but reward-based learning platforms provide immediate and granular feedback to short-term learning behaviors. This concept is analogous to reward systems in smartphone game quests or continuous attendance bonuses, and it is expected that applying such mechanisms in the educational field can increase learner immersion.

Today, this approach can be implemented more precisely through the convergence of advanced technologies. In particular, the adoption of Artificial Intelligence (AI) and Blockchain technology is considered a core innovative element of reward-based learning platforms. AI helps learners avoid frustration and achieve success by analyzing their level and weaknesses in real-time to provide personalized learning paths and feedback. For example, AI-based Adaptive Learning Environments (ALEKS, etc.) present problems, offer hints, and adjust the learning pace according to each student's comprehension level. This role in supporting individualized learning is especially valuable in situations with large class sizes or teacher shortages, thereby contributing to the reduction of quality disparities in education. Meanwhile, Blockchain technology can be utilized to ensure transparency in certifying learning achievements and managing rewards. By recording a learner's completion certificates, badges, or points on the blockchain, which are tamper-proof and universally verifiable, these records can serve as a form of digital academic transcript.

Furthermore, by issuing tokens via blockchain and distributing them to learners, these can be stored as digital assets or linked to other services to convert them into economic value. For instance, the blockchain academic management system trialed in Estonia, or the privately operated BitDegree platform, rewards students who complete courses with cryptocurrency tokens, connecting education with financial incentives. In such models, learners can be designed to use the accumulated tokens to receive mentoring services, access additional advanced courses, or exchange them for real currency through an exchange. In essence, the reward-based experience and learning

platform is a new paradigm that promotes educational participation by combining learning optimization via AI and reward transparency via blockchain, granting the learner direct benefits under the premise of "earning through learning."

In summary, the learning-reward approach is an educational innovation strategy that boosts learning motivation through economic incentives, social recognition, and game-like elements, while utilizing technology to manage the process. In the following Chapter 3, based on this theoretical framework, we will examine the concrete manifestations and causes of current global educational inequality, followed by Chapter 4, which will systematically present solutions for alleviating inequality using a reward-based learning platform.

2.4 Representative Global Free Learning Platforms

The emergence of various free educational platforms worldwide has led to significant progress in terms of enhancing knowledge accessibility. Representative examples include Khan Academy, Duolingo, edX, and Coursera, each offering content optimized for different target learners and subject areas. Khan Academy focuses on basic subjects like mathematics and science, while Duolingo features a globally accessible structure through game-based language learning. edX and Coursera offer university-level courses online, either for free or at a low cost, in collaboration with leading global universities such as Harvard, MIT, and Stanford.

However, these platforms commonly share the following structural limitations:

- Lack of Sustained Learning Induction: Most platforms lack robust reward structures or community-based motivation systems, resulting in high dropout rates after initial enrollment.
- Lack of Real-World Connection: Learning outcomes often do not directly translate into economic rewards or social activity, making it difficult to provide substantial motivation, especially for marginalized groups.

- Technology/Language Barriers: Some platforms require high-specification devices or high-speed internet environments, and a lack of content diversity in various languages reveals accessibility limitations for users in underdeveloped countries.

<Table 1> Comparison of Major Global Educational Platforms

Platform	Key Features	Strengths	Weaknesses
Khan Academy	Basic academics focused, non-profit	Free, diverse languages, targets all ages	No direct rewards, inadequate learning induction system
Duolingo	Game-based language learning	Excellent accessibility, superior UX	Limited content scope, low learning persistence
edX	University-focused higher education content	Academic depth, credentialing available	Focuses on advanced content, lacks practicality/reward elements
Coursera	Mixed paid/free model, offers certifications	Includes practical courses, corporate/university partnerships	Primarily a paid structure, presents a barrier to entry for low-income groups

Chapter 3. Analysis of the Status and Causes of Global Educational Inequality

3.1 Current Status of Educational Gaps by Region and Nation

a. The Gap Between Developed and Developing Countries

Global educational disparity shows a close correlation with the level of economic development by region. Generally, high-income countries exhibit higher rates of educational provisioning and academic achievement, while low-income countries have lower enrollment rates and educational attainment levels.

For example, in developed nations such as North America and Western Europe, the net enrollment rate for primary education is nearly 99%, and most students complete secondary education. In contrast, in Sub-Saharan Africa, approximately 20% of children do not attend primary school, and nearly half leave school by the secondary level. According to UNESCO statistics, the global out-of-school children rate for primary age children is about 9.4%, but this varies significantly by region: 4.2% in East Asia and the Pacific, 8.6% in South Asia, and 19.7% in Africa. The gap widens further at higher education levels; approximately half (49.0%) of secondary-school-aged adolescents in Africa are out of school, whereas the proportion of out-of-school youth of the same age in Europe and North America is very low, below 5%.

In absolute terms, out of the world's 250 million out-of-school youth, about 40%, or 98.4 million, are concentrated in Sub-Saharan Africa, while Europe and North America account for only about 4.2 million, a negligible number. The total number of out-of-school children in Latin America and the Middle East and North Africa remains substantial at approximately 9.7 million and 14.9 million, respectively, indicating that the issue of non-enrollment in education is severe across developing countries.

Thus, the inter-country gap is a facet of global inequality: developed nations are producing human resources that lead the knowledge economy through tertiary education, while many in least developed countries still lack basic literacy, creating an educational polarization.

b. Regional Gaps Within a Nation

Educational gaps based on region and social stratum exist even within a single country. The disparity in educational access is often most pronounced between urban and rural areas. Rural or remote mountainous regions frequently show lower enrollment rates and academic achievement than urban areas due to a lack of school facilities or geographical inaccessibility. For instance, in populous countries like India or China, significant differences in literacy rates and average educational attainment are reported between major metropolitan areas and rural regions.

Furthermore, due to discrepancies in educational investment at the state or local government level, schools in affluent areas of a country often have adequate facilities and teacher supplies, whereas schools in impoverished areas are frequently situated in suboptimal environments.

These internal disparities manifest not only in the least developed countries but also in middle-income nations. Data from the OECD’s Programme for International Student Assessment (PISA) indicates that students in middle-income countries in Latin America and South Asia lag several years behind the OECD average in academic achievement. Moreover, the achievement gap between high-income students in urban areas and low-income students in rural areas within those same countries is extremely wide. Specifically, one analysis suggests that students in middle-income countries perform about five years behind the OECD average in learning achievement, showing a gap of over seven years when compared to top-performing nations like Singapore.

Moreover, according to the World Bank's **Learning Poverty** index, which is based on the "reading comprehension ability of a 10-year-old," the situation varies significantly: in Sub-Saharan Africa, 9 out of 10 children cannot read and understand even simple sentences at a comic book level, whereas the figure is about 56% in Latin America and less than 3% in some East Asian countries and Northern Europe. This statistic starkly illustrates the gap in educational quality within regions, suggesting that educational inequality extends beyond mere school attendance to differences in the

quality of learning and mastery. Ultimately, without tailored support policies for vulnerable regions within a nation, regional educational inequality risks becoming entrenched as a gap across regions and generations.

3.2 Digital Divide and Educational Accessibility Issues

One significant aspect of 21st-century educational inequality stems from differences in educational accessibility caused by the **Digital Divide**. Although online education content and remote learning have become widespread with the advancement of internet and computer technology, the resulting gap in educational opportunities between regions with and without digital infrastructure has emerged as a new challenge. According to the International Telecommunication Union's (ITU) 2023 report, approximately 67% of the world's population uses the internet, while 33% remain offline. By national income level, the internet usage rate reaches 93% in high-income countries, but only 27% in low-income countries, a gap of a full 66 percentage points. Regionally, the average internet penetration rate in the African continent stands at only 37%, half the global average (67%), and the average usage rate for the Least Developed Countries (LDCs) is only 35%.

The digital divide is not merely an issue of communication access; it acts as a severe factor for inequality in the education sector. When many countries shifted school classes online during the COVID-19 pandemic, students in regions without internet and devices were effectively forced to halt their learning. A UNESCO report stated that during school closures due to COVID-19 in 2020, 40% of low- and middle-income countries failed to support vulnerable students in remote learning, which further widened existing gaps. Students without home internet thus lose opportunities to access modern educational resources such as MOOCs, educational apps, and digital libraries, not only during crises but also in normal times.

Furthermore, the digital divide encompasses more than just whether one has an internet connection; it includes differences in connection speed and quality, the availability of usable digital devices (smartphones, tablets, PCs, etc.), and disparities in **digital literacy**. Rural schools in developing countries often struggle with slow internet

speeds or unstable electricity, making smooth online classes difficult, and many households lack dedicated learning devices, leading siblings to share a single mobile phone to attend classes. Moreover, in places where teachers or students are not adept at using computers, a culture of self-directed learning utilizing online materials struggles to take root. An analysis by UNICEF-ITU also pointed out that even when the internet is available at home, actual utilization rates are lower due to factors like children being burdened with domestic labor, insufficient device availability, or parents being unable to provide technical guidance.

In short, the gap in digital accessibility and competency is causing new educational inequalities, and without resolving this, technological innovations in education may inadvertently deepen inequality. Therefore, strategies to alleviate educational inequality must necessarily be accompanied by efforts to expand digital infrastructure and enhance digital competency. Examples of global initiatives for this include the aforementioned GIGA project (Internet connectivity for every school), and policies within individual nations that promote public Wi-Fi expansion, satellite internet for rural areas, establishment of school computer labs, and the provision of tablets to students.

3.3 Socioeconomic and Cultural Factors

When examining the fundamental causes of educational inequality, economic poverty repeatedly emerges as the core factor. Children from poor families often suffer from learning deficits due to malnutrition or health issues, or they have a higher rate of dropping out due to the burden of direct and indirect educational costs, such as purchasing school supplies and uniforms. An analysis by the World Economic Forum (WEF) indicates that children from the top 20% wealthiest families in low- and middle-income countries are more than three times as likely to complete secondary education compared to children from the bottom 20% poorest families.

This illustrates a significant gap in educational attainment based on household income level even within the same country. Moreover, children from extremely poor households often never enroll in primary school at all or are forced into the labor market

at a young age to earn a living. This vicious cycle of poverty and education hinders national development, leading many researchers to emphasize that poverty alleviation must lead to the alleviation of educational gaps, creating a virtuous cycle where universal education contributes to poverty reduction. Indeed, research by Hanushek, Gust, and Woessmann (2022) estimates that if all youth worldwide possessed basic skills, an economic value equivalent to five times the current world GDP could be generated. This suggests that efforts to resolve educational inequality are a critical issue directly linked to the growth of the entire global economy, beyond mere considerations of social justice.

In addition to economic factors, sociocultural factors are also major determinants of educational opportunity equity. Gender disparity has traditionally been a significant source of inequality in education. While decades of efforts by international organizations have largely bridged the gap in enrollment rates between male and female students, the reality remains in some regions that female students have lower access to education than male students. As of 2018, females constituted about 48% of the world’s out-of-school children and adolescents, a proportion nearly equal to males, yet in some low-income countries in Africa and South Asia, the proportion of females was significantly higher. This is often due to cultural customs and fixed gender roles. For instance, in Afghanistan, following a change in regime, the official prohibition on girls and women advancing to secondary or higher education has disenfranchised over 3 million girls and women, leading to a renewed increase in the global out-of-school population.

Beyond such extreme cases, in many developing countries, daughters from poor families are withdrawn from school early and pushed into domestic labor or early marriage due to the custom of prioritizing sons' education. Therefore, gender-equal education policies (such as scholarships for female students or provision of female-only dormitories) remain a crucial agenda item.

Another social factor is discrimination based on minority groups and social class. Children belonging to racial or religious minorities, immigrants, refugees, and persons

with disabilities are often excluded or discriminated against within the education system. For example, children from ethnic minority groups whose native language differs from the official language of instruction are at higher risk of falling behind or dropping out because they cannot comprehend lessons conducted in the majority language. Refugee children often experience educational discontinuity because enrolling in regular schools is difficult. In countries with inadequate special education support, the school enrollment rate for students with disabilities is markedly low. Societal prejudice or low expectations also serve as limiting factors for the educational achievement of certain groups. The educational level of parents also has a significant impact; if parents lack education, they are more likely to have a lower awareness of the importance of their children's education, leading to early school withdrawal or low achievement. These sociocultural factors present opportunities for mitigation through policy intervention. For instance, programs such as introducing multicultural education, providing supplementary materials in minority languages, supporting inclusive education for the disabled, and running female education campaigns have yielded positive effects. Examples like the introduction of minority languages into the school curriculum in the state of Odisha, India, or the flexible adjustment of the academic calendar for nomadic families in Kenya, are good examples of inclusive education policies that consider cultural context.

Finally, a nation's policy commitment and governance are also identified as crucial causes of educational disparities. In some countries, the lack of legislation and policy regarding educational support leaves vulnerable populations with no formal channel to assert their right to education. According to a UNESCO report, less than 10% of surveyed countries had "laws that fully include the right to education for all children and youth." This suggests that the absence of legal and institutional frameworks constitutes another axis of educational inequality. Moreover, in places where state functions are weakened due to corruption or conflict, the management of the education system is compromised, leading to unbalanced resource allocation across regions and consequently widening the gap.

As examined above, the causes of educational inequality are complex, including economic hardship stemming from poverty, discrimination based on gender or social

status, cultural customs and lack of awareness, insufficient digital access, and deficiencies in policy frameworks. In the following chapter, we will propose the reward-based learning and experience platform as one innovative approach to resolving these factors and discuss concrete implementation strategies.

Chapter 4. Addressing Inequality Through a Reward-Based Learning Experience Platform

4.1 Designing a Reward System for Learning Motivation Enhancement

In many developing countries, classroom overcrowding and limited educational resources often lead to diminished student motivation. Alleviating educational inequality necessitates creative strategies capable of continuously fostering learning motivation even under such adverse conditions. The **Reward-Based Learning Platform** aims to guide learners to persist in their studies, rather than abandoning them despite difficult circumstances, by providing clear motivational elements. A systematic design for these rewards is crucial for this purpose.

Rewards can be either material or take the form of digital recognition. The key is to design rewards in a way that does not undermine intrinsic motivation; rewards should be positioned to complement the enjoyment and sense of accomplishment derived from learning itself. For instance, by introducing performance-based rewards, points or Badges can be instantly issued upon achieving small learning milestones (e.g., completing a unit, achieving a certain score), allowing students to visually confirm their progress and feel a sense of achievement. This feedback-based reward system enhances immersion by making learning feel like a game. Actual research confirms that the introduction of game elements, such as awarding points for task completion and ranking based on accumulated scores, significantly improves attendance and assignment completion rates.

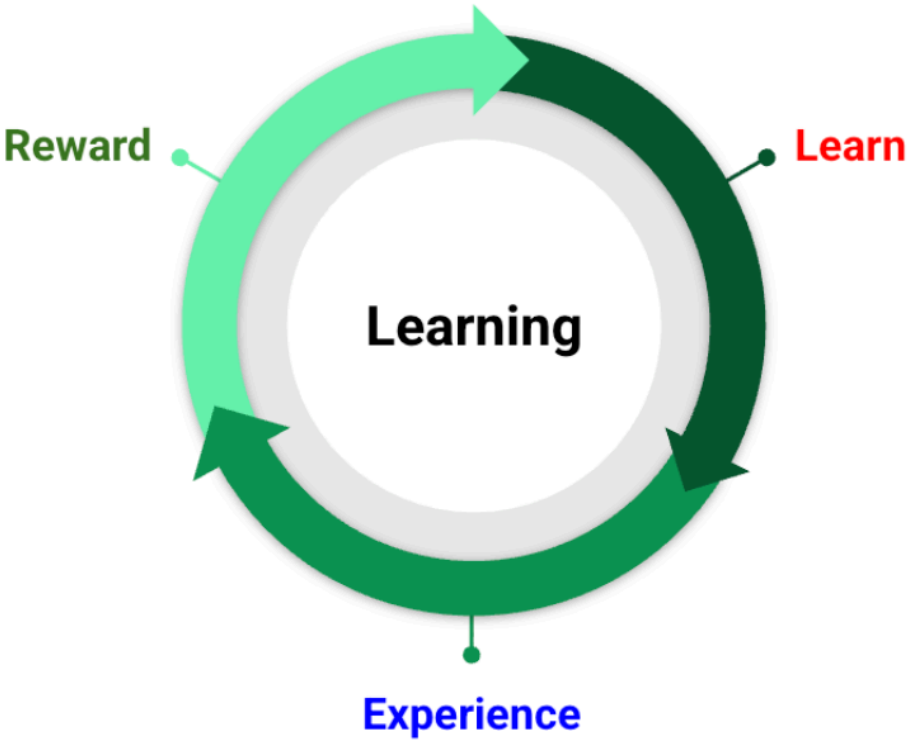

Figure 1. Educational Learning Token Economy Model

When designing the reward system, it is important to ensure it supports the formation of long-term learning habits. Instead of relying solely on one-off rewards, a continuous and cumulative incentive structure must be established. For example, continuous learning can be induced by offering bonus points for five consecutive days of participation or awarding special badges for consistent activity over a specified period. Furthermore, diversity and multi-level structuring of rewards are necessary. Some rewards should be immediate (e.g., 100 points awarded for a perfect score on today's quiz), while others should present long-term goals, such as awarding an official certificate and commendation upon completing all courses over a year. In such cases, delayed rewards should take the form of formal recognition, like scholarships, certificates, or diplomas, to be beneficial to the learner's future career.

The types of rewards must also be designed to match the learner's interests and needs. Digital badges or trophies can stimulate the desire for recognition of

achievement and social sharing. For instance, displaying badges such as "Math Master" or "Perfect Attendance Award" on a student's profile can have a positive motivational effect. In contrast, tangible rewards provide the economic incentive necessary for sustained learning. For impoverished students, small scholarships or textbook support can be immensely helpful. Recently, some digital platforms have attempted to link learning to actual economic value by issuing cryptocurrencies or tokens to learners. For example, in some pilot projects in Ethiopia, a reward system was operated where middle and high school students could exchange points earned from solving online quizzes for mobile phone communication data, thus encouraging participation in e-learning without worrying about data costs. Similarly, the **Yoma Platform**, supported by UNICEF and others, is designed to provide digital tokens to African youth upon participation in learning and social service activities, which can then be used at local stores for paying for transportation, mobile data, or communication fees. These rewards act as a form of micro-scholarship, helping to prevent situations where learning must be halted due to economic hardship. As seen in the Yoma case, linking **“rewards directly to tangible benefits”** can effectively elicit active learner participation.

Finally, fairness and transparency must be guaranteed in the reward system design. Learners trust and participate more when they perceive the criteria for rewards as clear and applied equally to everyone. For this reason, utilizing blockchain records allows for the transparent management of learning achievements and reward distribution histories. Furthermore, a balanced design is required that includes mechanisms to prevent misconduct (e.g., having someone else complete homework) and encourages collaborative learning by mitigating excessive competition. For instance, one could consider introducing team-based collaborative missions alongside individual competition, and also assigning scores to the learning process itself to ensure that achievement results are not the sole focus. A systematic and sophisticated reward design can reinforce learning motivation and increase learner participation, serving as a key tool for reducing

4.2 Reward-Based Learning Ecosystem

A reward-based learning ecosystem is a structural system that integrates the interactions among multiple agents performing diverse roles and the supporting technological infrastructure, extending beyond the learning behavior of a single learner. This section theoretically explores how learner-centric reward mechanisms organically operate within a socio-technical environment.

a. Components and Agent Roles of the Learning Ecosystem

The reward-based learning ecosystem is a multi-agent system where various entities mediating and supporting learning operate in a complex manner, not limited only to platform users. The primary agents can be categorized as follows:

- **Learner:** The central subject who consumes content, completes assignments, and whose learning behavior is reinforced through feedback and rewards. Their participation is sustained by a reward structure based on repetition and immediacy, which enhances their **self-efficacy** and **retention**.
- **Tutor/Coach:** An assistant who monitors the learner's progress and provides emotional and cognitive support, guiding them with personalized feedback and learning strategies to induce immersive learning. A crucial role here is continuous intervention for learners whose motivation has declined or who are falling behind educationally.
- **Creator (Content Provider):** The entity that designs and supplies learning materials (quizzes, project assignments, audiovisual content, etc.), establishing the starting point for learning participation. Content is designed considering difficulty adjustment, topical diversity, and real-world relevance, and is periodically optimized through AI.
- **Examiner/Moderator:** Performs the role of objectively measuring learning outcomes and managing the fairness and ethical standards of examination attempts and assignment submissions. Automated scoring systems and AI-based plagiarism detection functions are employed, often supplemented by

manual review for some high-level evaluations. This serves as a critical step in guaranteeing the fairness of rewards.

- **Certifier (Credential Issuer):** Plays the role of formally verifying the learner's history (time spent, scores, badges, completion records, etc.) and converting it into shareable digital assets. Blockchain technology is utilized to prevent forgery of records, and credentials are issued in the form of **verifiable credentials** that can be submitted to third parties (employers, schools, etc.).

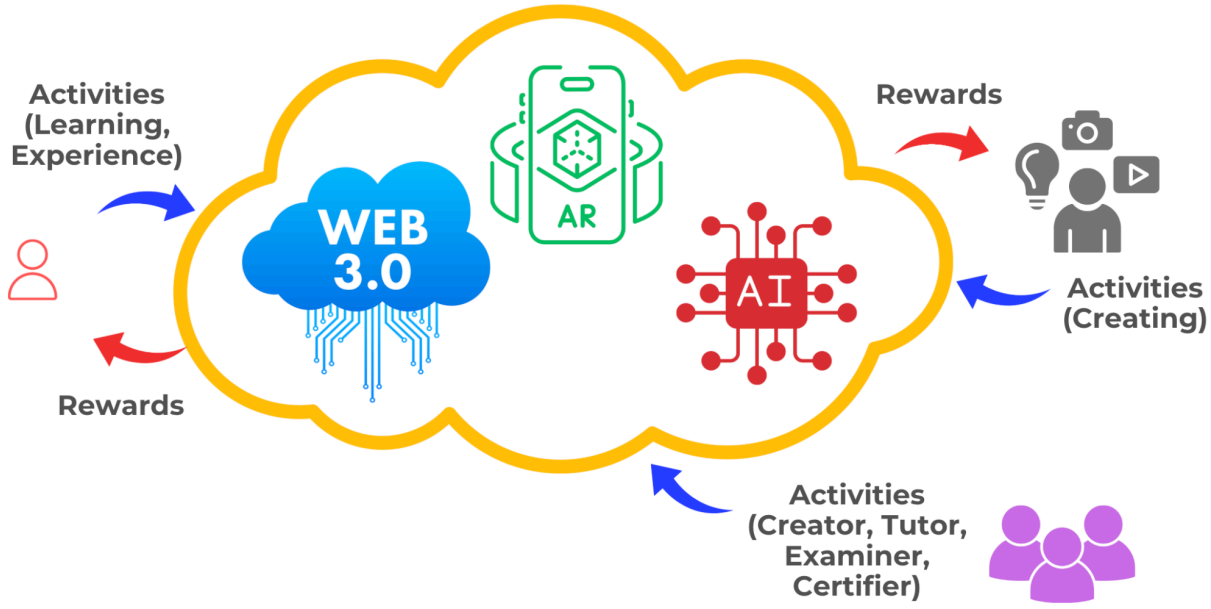

Figure 2: Interaction between Agents (Learner and Learning Environment)

The types of rewards must also be designed to match the learner's interests and needs. Digital badges or trophies can stimulate the desire for recognition of achievement and social sharing. For instance, displaying badges such as "Math Master" or "Perfect Attendance Award" on a student's profile can have a positive motivational effect. In contrast, tangible rewards provide the economic incentive necessary for sustained learning. For impoverished students, small scholarships or textbook support can be immensely helpful. Recently, some digital platforms have attempted to link

learning to actual economic value by issuing cryptocurrencies or tokens to learners. For example, in some pilot projects in Ethiopia, a reward system was operated where middle and high school students could exchange points earned from solving online quizzes for mobile phone communication data, thus encouraging participation in e-learning without worrying about data costs. Similarly, the Yoma platform, supported by UNICEF and others, is designed to provide digital tokens to young Africans upon participation in learning and social service activities, which can then be used at local stores for paying for transportation, mobile data, or communication fees. These rewards act as a form of micro-scholarship, helping to prevent situations where learning must be halted due to economic hardship. As seen in the Yoma case, linking "rewards directly to tangible benefits" can effectively elicit active learner participation.

Finally, fairness and transparency must be guaranteed in the reward system design. Learners trust and participate more when they perceive the criteria for rewards as clear and applied equally to everyone. For this reason, utilizing blockchain records allows for the transparent management of learning achievements and reward distribution histories. Furthermore, a balanced design is required that includes mechanisms to prevent misconduct (e.g., having someone else complete homework) and encourages collaborative learning by mitigating excessive competition. For instance, one could consider introducing team-based collaborative missions alongside individual competition, and also assigning scores to the learning process itself to ensure that achievement results are not the sole focus. A systematic and sophisticated reward design can reinforce learning motivation and increase learner participation, serving as a key tool for reducing educational gaps even in disadvantaged environments.

4.3 Strategies for Improving Digital Platform Utilization and Accessibility

The effective implementation of a reward-based learning strategy heavily relies on the role of the digital learning platform. Online platforms are considered a core means of improving accessibility in bridging educational inequality because they can provide educational resources beyond geographical limitations. However, considering

the digital divide examined in the previous section, strategies for enhancing accessibility must be developed concurrently with platform design.

First, multi-platform support and offline accessibility are essential. Many students in developing countries do not own expensive PCs or the latest smartphones. Therefore, platforms must be designed to run smoothly even on low-specification smartphones or older devices, wherever possible. This requires comprehensive technical design, such as developing lightweight, text-based or low-graphic-intensive application designs, or even SMS-based quiz systems for feature phones. Supporting an offline learning mode is also crucial. For example, the **Learning Passport**, developed by UNICEF and Microsoft, includes functionality allowing offline access to content for regions with unstable internet connections. Students can download content once and study repeatedly without data connectivity, with their learning history synchronizing to the server upon later internet connection. This approach minimizes network constraints, allowing the platform to encompass a broader segment of the population.

Second, personalized learning support utilizing AI technology must be integrated into the platform. AI can be a powerful tool for bridging the educational divide. Personalized learning, tailored to each learner's level and pace, can enhance learning efficiency, especially in situations with teacher shortages or large class sizes. For instance, an AI tutor can review prerequisite concepts for students lacking a foundation while offering advanced problems to high-achieving students, allowing each to be challenged at their optimal difficulty level. Furthermore, AI can analyze large-scale assessment data to diagnose learning patterns and proactively identify students at risk of dropping out, sending alerts or connecting them with teachers or mentors. The Early Warning System developed in the United States analyzes student attendance, assignment submission, and quiz scores to flag those at high risk of academic discontinuation; applying this to online education in less developed countries enables learning management and advising even where dedicated teachers are scarce. Moreover, a support service where students can receive 24-hour answers to their queries via an AI chatbot can also be implemented. This AI-based personalized support

is expected to reduce disparities in educational quality, thereby improving learning effectiveness and increasing learner retention rates.

Third, a reward management and certification system incorporating blockchain technology must be established. Various digital credentials (certificates, badges) or points/tokens awarded by the reward-based learning platform can be transparently managed through the blockchain. This enhances learner trust and offers the advantage that credentials can be used for submission to external bodies or employers with recognized credibility. For example, if a student completes a coding course on an online platform, that certificate can be registered on the blockchain to make it forgery-proof and unalterable. Additionally, by storing learning history data—such as cumulative learning hours, acquired badges, and received evaluations—on the blockchain, learners can build their own digital learning portfolios. The Yoma platform, for instance, verifies youth service achievements and learning accomplishments via blockchain to build a digital curriculum vitae (CV), which is then used to support the youth in employment. This serves as a useful tool connecting education and employment, allowing even youth from vulnerable backgrounds to build an alternative, trustworthy credit profile. Meanwhile, a blockchain-based token economy promotes the activation of the platform ecosystem. For example, by providing digital wallets to manage and trade tokens awarded as learning rewards, and linking these to other educational services or the local economy, tangible benefits can be provided to learners. However, for such a token economy system to succeed, the stability of the token's value and the scope of its utilization must be secured, necessitating cooperation with private companies and financial institutions in the PPP model to be discussed later.

Fourth, platform design that considers localization and inclusivity is vital. While universally applicable educational content should be provided everywhere, content must simultaneously be localized to regional languages and cultures. For instance, it is desirable to support the platform interface and learning content in multiple languages and to add explanations reflecting local cases and contexts. The Yoma platform strives to lower language barriers by offering versions in local African languages (such as Kirundi and Swahili) in addition to English and French. Furthermore,

accessibility technologies (compatibility with screen readers, provision of subtitles, etc.) must be applied so that learners with disabilities can participate. It is also important to create neutral and inclusive learning content that all individuals can relate to, regardless of gender or cultural background.

Finally, the platform's own scalability and sustainability must be secured. While this relates to the PPP model discussed later, technical platforms often become defunct if long-term maintenance is not sustained after initial introduction. Therefore, a strategy for widespread diffusion, rather than confinement to a specific region or a short-term pilot, must be developed, such as open-sourcing or integrating the system into a government's unified platform. For example, integrating a reward system module into a national learning platform or adopting a model where multiple countries jointly use a platform managed by an international organization are viable options.

These digital platform utilization strategies, combined with the reward systems discussed previously, aim to create an environment where education is **"accessible to everyone, optimized for the individual, and immediately rewarded upon learning."** When this is achieved, even a poor student in a remote area can receive world-class education and feel an equal sense of accomplishment with just a smartphone, which is expected to provide a major turning point in alleviating educational inequality.

4.4 Implementing Immersive Learning Through Experience

To resolve educational inequality, the **Quality** of learning must also be guaranteed. It is important to actually acquire meaningful learning experiences and cultivate useful competencies, not just to attend school. However, in the poorly equipped schools of developing countries, the lack of opportunities for hands-on, experiential learning—such as in laboratories, libraries, or through field trips—can widen the learning gap. The solution emerging for this issue is the utilization of immersive learning technologies such as VR (Virtual Reality), AR (Augmented Reality), and the Metaverse. These technologies contribute to overcoming physical constraints by providing **"experiential learning environments virtually."**

Using VR/AR technology, students can safely and affordably engage in experiences that closely resemble reality. For example, in a virtual reality laboratory, they can follow experimental procedures and observe results firsthand without the need for expensive chemicals or equipment. They can take virtual field trips to museums or historical sites in other countries, or use AR applications to observe 3D models of anatomical structures or the movements of the solar system in the classroom. Such experiences aid in vivid comprehension of the learning material, making abstract concepts easier to grasp. VR/AR can serve as a tool to stimulate interest and encourage active participation, especially for students accustomed only to rote, textbook-based instruction. As learners directly manipulate and explore in an interactive virtual environment rather than just listening and watching, the effect is enhanced immersion and increased memory retention duration.

The Metaverse goes a step further, enabling learning within a social virtual space. For example, a virtual campus or classroom can be established where students from all over the world gather as avatars to attend lectures or participate in discussions. Within a Metaverse platform, problem-solving assignments can be undertaken like solving game quests, or historical or literary scenarios can be reenacted through role-playing. This not only increases motivation and enjoyment in learning but also promotes collaborative learning among geographically dispersed students, thereby fostering a global mindset. Initial attempts are already underway, with some universities offering lectures on virtual campuses and international organizations running teacher training programs utilizing virtual reality.

Certainly, the widespread adoption of such immersive learning techniques has been hindered by the cost of VR/AR equipment or issues with technological accessibility. However, accessibility is improving with technological advancements leading to the emergence of simplified VR gear (like smartphone cardboard viewers) or more affordable Mixed Reality (MR) devices. Furthermore, educational VR content is increasingly being developed in formats executable on mobile devices. For instance, experiential learning content based on 360-degree panoramic videos can be utilized

even with low-cost devices, and in the long term, immersive learning technology is projected to narrow educational gaps through cost reduction and content accumulation.

AR/VR technology will contribute to alleviating the differences in learning experiences caused by limitations in where students live or the resources available at their schools by providing experiences that are difficult to conduct in reality due to distance or cost, virtually. For example, if a student attending a rural school virtually tours a science museum in a city via VR, conducts an experimental simulation, and discusses opinions with friends from various countries in a Metaverse forum, they are gaining educational experiences similar to those of students in well-equipped urban schools. This experience-centered, immersive learning is expected to have the positive effect of offering equal learning opportunities to students from different backgrounds, thereby increasing interest in education and boosting retention rates.

4.5 Public-Private Partnership and Linkage Model with International Organizations

Resolving the issue of global educational inequality requires the cooperation of diverse stakeholders. Only by forming partnerships among governments, international organizations, private companies, local communities, and NGOs to pool resources and capabilities can proposals like the reward-based learning platform be effectively implemented and sustained. We examine this Public-Private Partnership (PPP) and international linkage model from several aspects.

a. Government and Policy Support

National governments must play a central role in creating the policy environment and allocating resources as the primary agent for resolving educational inequality. First, efforts are needed to integrate the concept of reward-based learning into national educational policies. For example, establishing a national online learning platform and introducing a reward system therein can provide standardized benefits across the country. Countries like India and Indonesia have examples where the government operates public e-learning platforms, issuing digital certificates or implementing awards

for outstanding learners. Furthermore, governments can provide financial support to subsidize the cost of necessary digital devices (e.g., tablet distribution) and internet access for vulnerable students. Policies such as Uruguay's **Plan Ceibal** or the **One Laptop Per Child (OLPC)** initiative in Thailand are examples where the government proactively provided digital devices per student to reduce the gap. Specifically, introducing incentive schemes (e.g., attendance subsidies, scholarships for grade improvement) targeted at rural and low-income populations within the public education system can be effective in easing educational disparities. Governments should also act as facilitators to promote cooperation between the private sector and international organizations by supporting the growth of reward-based platforms through regulatory refinement (e.g., EdTech certification, personal data protection), tax incentives, and co-funding.

b. International Organizations and Multilateral Cooperation

Since education is a global agenda, the support and coordination role of international organizations such as UNESCO, UNICEF, the World Bank, and UNDP are crucial. International organizations can create synergy by sharing experiences and resources gained from various countries. For example, UNICEF is advancing projects to enhance digital learning access in collaboration with national governments and corporations through its **Reimagine Education** initiative, which includes the **GIGA project** with the ITU, aiming to connect every school to the internet by 2030. This project has already mapped the connectivity status of 800,000 schools in 30 countries and is proceeding with infrastructure development by introducing innovative financing models (blended finance) in conjunction with national governments and corporations. Such large-scale international cooperation offers a breakthrough for the infrastructure problems of the digital divide that individual nations find difficult to solve alone. Moreover, continuous monitoring of national performance and disparities by programs like UNESCO’s Global Education Monitoring (GEM) Report and OECD’s Education Indicator Program guides policy directions. International organizations can establish best practices and standards for countries adopting new approaches like reward-based learning through guidelines and technical support. For instance, policymakers globally

utilize documents such as UNESCO's Ethics of AI in Education guidelines and the World Bank's reports analyzing EdTech effectiveness. Furthermore, partnerships transcending borders are formed in forums hosted by international organizations (e.g., Education 2030 Forum). These multilateral forums strengthen global solidarity for resolving educational gaps and form the basis for identifying joint projects.

c. Private Sector and Innovation Ecosystem

The participation of the private sector is essential for technological innovation and securing financial resources. Global IT corporations and local start-ups are leading innovations in educational methodologies by developing and providing EdTech solutions. For example, Microsoft contributed to the development of the Learning Passport platform with UNICEF, and Google supports educational projects through the provision of its cloud infrastructure and Chromebooks. Telecommunications companies also assist student internet access by installing base stations in rural areas or offering discounted data plans. While corporate social responsibility (CSR) collaboration is common, there is an increasing trend of private entities participating in the education market as a sustainable business model. An example is the private school network Bridge International Academies in Kenya, which standardizes learning through ICT to reduce operational costs while offering low tuition fees. The blockchain and cryptocurrency sectors are also showing interest in education, investing in coin-based learning reward platforms or running their own educational programs. Policy incentives are needed to encourage the growth of public-interest-linked business models (Social Business) where this private innovation aligns with public goals. Governments and international organizations can encourage collaboration by offering incentives such as tax reductions or promotional support to private partners participating in joint projects. Simultaneously, the private sector can contribute to a virtuous cycle of social value and corporate profit by building scalable and user-friendly platforms utilizing their technology and expertise, and by improving services based on feedback from the educational field.

d. Role of Local Communities and NGOs

The efforts of NGOs and local organizations working on the front lines to eliminate educational inequality are also vital. They support individual children by operating learning centers, providing mentorship, and offering scholarships in areas often beyond the reach of government services. For the reward-based learning platform to be truly effective, it must be combined with this human support. For instance, even if an e-learning center is established in a village providing tablets and internet, its utilization rate may drop if there is no tutor to teach the children, who are new to technology, how to use the tools and help them form learning habits. Here, local volunteers or NGO activists can significantly enhance learning effectiveness by acting as mentors, encouraging study, and providing emotional support. Therefore, when pursuing platform implementation, it is necessary to coordinate with the local community, perhaps by training local teachers to participate as online tutors or by collaborating with parent associations to foster a supportive home learning environment. International NGOs can also contribute to the gradual improvement of the model by accumulating data on what approaches are effective through performance monitoring and evaluation, and sharing this internationally.

As demonstrated above, it is crucial for the government, international organizations, the private sector, and civil society to advance toward a common goal by leveraging their respective strengths. As a concrete example, the **Yoma Project** in Africa, introduced earlier, is evaluated as a successful model of multi-stakeholder collaboration, established through cooperation among UNICEF (UN), GIZ (German agency), the Botnar Foundation (Private), and RLabs (Social Enterprise). This project built an ecosystem encompassing EU and African local communities, providing opportunities to over 250,000 youth and distributing over 780,000 token rewards within just one to two years of its launch in 2020. This success was made possible by combining the financial and technical support from international partners with the execution capacity of local organizations. Expanding this model to other countries and flexibly applying it to other innovative endeavors can create tangible progress in resolving educational inequality.

Chapter 5. NodajiFi: Reward-Based Learning and Experience Platform

5.1 Purpose and Overview

Existing global free learning platforms (e.g., Khan Academy, Duolingo, edX, Coursera) have achieved positive results in disseminating educational resources utilizing digital technology. However, most of them possess a structural limitation: they fail to provide sustained learning incentives, and their learning outcomes are not directly connected to real life. In contrast, the **NodajiFi** platform is designed as a next-generation learning platform equipped with integrated functions, including a technology-based reward structure, immersive experiential learning, real-life utility of digital rewards, and a community-based resource circulation. This chapter will analyze the core functions and design principles of NodajiFi in a multi-layered manner and specifically examine how it can contribute to bridging educational inequality.

5.2 Reward-Based Learning Structure

The core design philosophy of NodajiFi is **“Learn & Earn,”** meaning a structure where the act of learning immediately leads to a reward. Learners receive real-time compensation upon completing unit assignments or specific educational courses, which reinforces the sense of achievement and induces repetitive learning behavior. Rewards are primarily provided in the following three forms:

- **Digital Certificates and Badges:** Visually represent individual achievement and can be utilized as indicators of credibility on online profiles.
- **Internal Points and Experience (EXP) System:** Performance tracking based on gamification principles.
- **Usable Tokens:** Issued based on blockchain technology, available for external exchange, purchase, or donation.

This is an attempt to overcome the limitation of existing educational platforms, which mostly feature a **‘delayed reinforcement’** structure where rewards are only given after a period of study, such as upon graduation, receiving a transcript, or obtaining a qualification. Such a method may be somewhat insufficient for immediate learner motivation, often becoming a cause for declining learning persistence, especially for learners with low motivation levels. Conversely, NodajiFi provides immediate reinforcement—digital badges, points, tokens—right after learning activities, making it a prime example of effectively integrating the principles of **operant conditioning**, as advocated by the behaviorist psychologist B.F. Skinner, into a digital learning environment. In essence, it leverages the structure where positive outcomes (rewards) immediately following a specific learning behavior increase the likelihood of that behavior's repetition. This can be an effective strategy for inducing and maintaining learning behavior, particularly among vulnerable learners with low intrinsic motivation.

5.3 Immersive Experiential Learning Design

NodajiFi is designed based on **gamification** strategies to induce learner immersion and foster repetitive learning behavior. Its goal is to simultaneously enhance learning persistence and practical application by guiding learners to actively set goals and experience achievement, moving beyond mere content consumption.

Crucially, NodajiFi is based on the following structural design principles:

- **Level-Up System and Quest-Based Design:** Learners proceed to increasingly difficult studies by completing unit quests (learning missions). Upon completing each quest, they earn experience points and points, and as their level rises, they receive both symbolic rewards (badges, titles) and tangible rewards (tokens, gift certificates, course discounts). This allows learners to visually confirm their growth and reinforces their **self-efficacy**.
- **Leaderboards and Collaborative Elements:** Learning achievement and activity metrics are visualized through real-time leaderboards, and the design encourages social interaction among learners through mechanisms like friend

invitations, team quests, and community missions. This aligns with Vygotsky's view of social constructivism and activates community-based learning.

- **Real-World Connected Tasks (PBL: Problem-Based Learning):** NodajiFi incorporates real community issues, cultural topics, or environmental concerns into learning assignments, guiding learners to apply knowledge and skills to actual problem-solving. For instance, activities such as analyzing local data related to climate change to draft policy proposals or creating content based on local indigenous culture enhance both the practicality and contextual relevance of learning.
- **Repetition and Learning Loop Reinforcement:** The platform incorporates an inherent **reward loop**—attendance bonuses, continuous learning bonuses, and daily quest rewards—based on B.F. Skinner's operant conditioning theory to continuously induce positive behavior. Users acquire cumulative rewards by participating in learning daily, promoting the formation of specific routines.
- **Personalized Feedback Provision:** The AI-based learning tracking system analyzes the learner’s weak areas and progress data to provide personalized quests and review content. This is designed to maintain a sense of challenge while helping the learner avoid frustration from excessive failure, aligning effectively with Vygotsky’s **Zone of Proximal Development (ZPD)** theory. Such difficulty adjustment is effective in inducing the ideal learning state described in Csikszentmihalyi's **Flow** theory.

Furthermore, learning outcomes are linked to real-life reward mechanisms provided by the platform (e.g., tokens usable as if they were currency within the platform), connecting learning directly to daily life and thus inducing practical motivation. This has a positive effect, particularly for learners with low motivation or those who have not yet established study habits.

The immersive experiential learning design of NodajiFi is an innovative structure that comprehensively reflects principles of behavioral psychology, social interaction theory, problem-based learning strategies, and real-life connected incentives, providing the **"motivated immersive experience"** that was lacking in previous learning

platforms. This design encourages learner autonomy and supports the transfer of learning outcomes into real-world problem-solving abilities, thereby contributing to the ultimate goal of education: improving the quality of life.

5.4 Blockchain-Based Trust System

The reward structure of NodajiFi possesses an essential differentiation from existing learning platforms in that it goes beyond simple point accumulation to implement a **digital assetification system** based on Blockchain technology. Users acquire various forms of rewards by participating in learning or completing assignments, all of which are recorded on the blockchain and cryptographically secured to guarantee reliability and permanence.

a. Permanent Recording of Learning History

Key learning activities occurring within the platform (e.g., content viewing, assignment submission, test scores, feedback receipt, completion) are automatically recorded as transactions on the blockchain. Each activity is stored with a **timestamp**, enabling the continuous tracking of the learner's progress without omission. These records serve as a **Verifiable Learning History** that can be independently verified without reliance on a central server, potentially contributing to the **interoperability** between platforms.

b. Tamper-Proof Digital Learning Credentials

Unlike traditional certificates or transcripts that rely on paper or central servers, the digital badges and certificates issued by NodajiFi are issued in the form of **NFTs (Non-Fungible Tokens)** or **DIDs (Decentralized Identifiers)** and stored on the blockchain. This method allows for the verification of both the issuing entity and the recipient’s identity, enabling external employing institutions, universities, or scholarship organizations to view and trust these credentials. In essence, users can compile their completed courses, acquired skills, and evaluation scores into a single **Verifiable CV**, utilizing it as credible learning certification material.

c. Practical Utility of Learning Rewards

The reward tokens issued by NodajiFi are designed not merely as indicators of learning achievement but as usable digital assets. Practical utility is realized in the following ways:

- **Mentoring Service Utilization:** Learners holding a certain amount of tokens can request mentoring from experts or advanced learners, forming a reward-based mutual learning ecosystem.
- **Access to Additional Courses and Premium Content:** Some premium content is unlocked through token payment, allowing users to expand their learning with their held tokens.
- **Use in the Digital Community Store:** Tokens can be exchanged for tangible goods, gift certificates, or data coupons at the platform's internal store or affiliated external vendors (e.g., local commerce, digital libraries).
- **P2P Trading and Contribution Rewards:** Learners can also receive tokens for contributing content (e.g., translation, review writing) or community activities, which reinforces the user-centric platform ecosystem.

This structure provides the foundation for expanding beyond a simple educational platform into a **reward-based educational ecosystem** by connecting learning and economic rewards. In particular, for low-income adolescents or those at risk of dropping out—who inherently find it difficult to be intrinsically motivated—this system can instill the perception that **'Learning = Tangible Opportunity,'** thus functioning as a catalyst for resolving educational inequality.

5.5 Technological Inclusivity and Accessibility

NodajiFi is designed not just as a functional learning platform, but under the philosophy that **"access itself is a right and a prerequisite for resolving inequality,"** enabling learning even in regions with poor technological infrastructure. Specifically considering that educational inequality is most severe in areas with low-income

countries, rural areas, refugee camps, and insufficient digital infrastructure, the platform adopts the following strategies for technological inclusivity:

a. Mobile-First Strategy and PWA-Based Architecture

NodajiFi adopts a parallel structure of a **Progressive Web App (PWA)**, usable without app installation, and a dedicated mobile application to maximize accessibility and ease of use on mobile devices. This design provides a technical foundation capable of flexibly responding to diverse user environments, offering several advantages:

- **Improved Accessibility:** Service usage is possible with just a browser connection, even in environments where app installation is difficult.
- **Platform Optimization:** Utilization of platform-specific features like push notifications and offline storage via the dedicated mobile app.
- **Flexible Deployment Strategy:** Diversification of user acquisition channels by running both the app market and the web presence.
- **Enhanced Service Stability:** Parallel maintenance is possible without being affected by specific platform issues.
- **User Choice Guarantee:** Users can freely choose between the web or the app based on their preference or device performance.
- **Web3 Friendliness Maintenance:** The PWA structure maintains platform independence and a decentralized philosophy, while the app-based version can offer advanced features such as authentication and wallet integration.

This parallel strategy is highly suitable for a platform pursuing both technological diversity and expansion of the user base. PWAs can be accessed directly through a web browser, enabling smooth service delivery even in environments where access to app markets like Google Play or the App Store is difficult. This structure is particularly effective in regions with high smartphone penetration but limited assurance of high-performance devices or high-speed networks.

The PWA-based design offers the following benefits:

- **No Installation Burden:** Executable with just a browser, even on low-capacity devices.
- **Automatic Updates:** Content is managed and distributed centrally without device-specific installation or updates.
- **Cross-Platform Compatibility:** Provides a consistent user experience across various operating systems and devices, including iOS, Android, Tablets, and PCs.
- **Platform Independence and Web3 Alignment:** Allows direct service provision to users without the approval of app stores (Apple/Google), aligning with the decentralized digital service philosophy (Web3) that transcends platform dependency.
- **Scalability for Wallet and Reward System Integration:** Enables the implementation of user sovereignty and a transparent reward system through integration with blockchain-based wallet connectivity, token rewards, and **Decentralized Autonomous Organization (DAO)** participation features.

b. Low-Capacity Content and Offline Learning Functionality

Considering countries with unstable internet access or high data costs, NodajiFi has optimized its content to be text-centric, audio-based lectures, and lightweight animations. Simultaneously, learners can download desired courses or content in advance to continue studying offline. This feature is particularly effective in environments such as:

- Users with daily data-capped mobile plans.
- Regions with unstable power supply, preventing frequent connection.
- Situations where internet access is periodically available in public facilities (e.g., schools, libraries).

Learning history is temporarily stored in local storage and automatically synchronized to the server when a network connection is re-established.

c. Multilingual Localization and Feature Phone Support

Considering users from diverse global cultures, NodajiFi supports multilingual translation of its UI and content, in addition to providing explanations and examples based on local case studies, an audio guidance mode for the visually impaired, and screen reader compatibility. Key elements that enhance accessibility include:

- Quiz content based on regional languages and dialects.
- Application of local accents to audio-based lectures.
- Communication methods that consider cultural sensitivity.

Furthermore, an **SMS-based quiz system** is supported to enable a certain level of learning participation for users of feature phones. This serves as a significant alternative in countries where smartphone penetration is below 50%, designed to allow participation in basic learning with only minimal text message transmission.

5.6 Real-Life Utility and Circular Economy Structure of Rewards

NodajiFi secures the economic efficacy of learning by making the rewards provided to learners usable in real life. Specific areas of utilization are as follows:

<Table 2> Scope of Reward Utilization

Area of Utilization	Details
Remittance	Ability to send reward tokens to family and friends (especially beneficial for youth in immigrant families).
Donation	Ability to donate digitally to NGOs or local public interest projects.
Purchase	Purchase of learning tools, cultural goods, groceries, etc., at the platform's internal store.
Local Trading	Ability to engage in local second-hand trading and bartering, similar to services like Craigslist or Kijiji.

This structure creates a virtuous cycle of knowledge and assets, extending beyond a mere educational platform to establish a reward-based educational

ecosystem. Specifically, it realizes the expanded goals of strengthening local communication, recycling resources, and integrating education, economy, and society.

5.7 Comparative Analysis of Platforms

When compared to the global learning platforms presented earlier, NodajiFi offers several critical differentiators and alternatives. This section compares the structural differences between the major platforms and NodajiFi, analyzing how the latter can contribute to bridging educational inequality.

First, NodajiFi adopts a structure that directly rewards content producers, thereby building a user-driven learning ecosystem. In contrast, most existing platforms follow a centralized revenue model where platform owners monopolize content revenue or profits are distributed only to a few course providers.

Second, NodajiFi can provide a smooth learning experience even in regions with poor technological infrastructure through its mobile-first PWA technology and optimization strategy for low-end devices. This represents a significant technological advantage that differentiates it from existing platforms reliant on high-specification devices or high-speed internet.

Third, NodajiFi integrates a reward-based learning structure, an experiential immersive learning environment, and a blockchain-based practical token system to implement a participation-based educational paradigm that goes beyond simple content consumption. Learners directly earn tokens through quizzes and exams, which they can then use to access other learning content or receive tangible rewards usable externally.

This structure can provide practical motivation for learners, particularly those from low-income backgrounds and youth learners for whom educational access and motivation are critical, presenting a new alternative to the structural problems of educational inequality that existing platforms have failed to solve.

<Table 3> Comparison of Major Global Educational Platforms

Category	Khan Academy	Duolingo	edX/Coursera	NodajiFi
Establishment Purpose	Provide basic education to all children globally	To allow anyone to learn a foreign language for free	To make world university lectures available online	Alleviate educational inequality through a reward-based system
Target Audience	K-12 Students	Language learners, all ages	Adults/University Students	All ages + priority for low-income groups
Primary Content	Math, Science, History, SAT prep, etc.	Language (Listening, Speaking, Writing)	University lectures, certification courses	Quizzes, insights, courses, exams; Practical training, experiential content; Cultural content; Immersive content
Learning Method	Video lectures + practice problems	Gamified interface	Assignment and discussion-centric	AI personalized recommendations + Metaverse-based experience
Reward Structure	None	In-app points (Lingots)	Certificate purchase (paid), limited usage	Learning → Acquire Blockchain Token → Real-life usage (Store, local trading)
Blockchain Certification	None	None	Limited	Successful learning history recorded on Blockchain

Technology Integration Level	Low: YouTube-based	Medium: Some AI voice recognition	Medium: LMS/Mobile compatibility	High: Integration of AI + Blockchain + AR/Metaverse
Technology Accessibility	Medium	Excellent	Medium-High	Low-spec device support, PWA-based, offline-friendly
Participation Structure	Passive learner-centric	Leaderboards & gamification	Course enrollment-centric	DAO structure: Linking creators, learners, sponsors; Activating User Generated Content (UGC)
Economic Utilization	None	None	Limited (Paid certificates)	Token-based remittance, donation, purchase functions
Content Production Method	Primarily expert-produced	Limited community participation	University and institutional-led	Active utilization of User Generated Content (UGC)
Revenue Model	Free provision, non-profit operation	Advertising + Premium	Paid courses, certificate sales	Centered on rewarding users/producers, decentralized base
Decentralization & Ownership	None	Limited	Corporation/Institution-led	DAO-based participatory operation structure
Real-Life Applicability	None	Limited	Cannot be used within the platform	Connectable to real life outside the

				platform (Web3 scalability)
Contribution to Educational Inequality Alleviation	Partial improvement in educational access	Increased language learning opportunities	High cost for certificates, technology barriers exist	Favorable to low-income countries and vulnerable groups via reward-inducing structure
Key Summary	Free, curriculum-focused education	Addictive language game	Online higher education	A virtuous cycle integrating rewards, experience, and learning

5.8 Platform Architecture and Policy Linkage Strategy

NodajiFi is designed to address global educational inequality, pursuing a balance between global scalability and regional customization in both its technical structure and policy linkage strategy. To this end, the platform adopts a technical architecture that comprehensively considers the diversity of client environments, reliable reward management, operational stability in local network conditions, and potential for integration with external institutions. Furthermore, it secures a basis for policy-level diffusion through strategic linkage with national education systems and international organizations.

a. Architectural Design

The NodajiFi platform adopts a dual sub-platform structure based on a learner-centric participation design, linking learning activities with tangible rewards. This is a strategic design choice intended to connect education not to an abstract goal, but to immediate practical implementation and social utility.

5.8.1 Learning Sub-Platform: Implementation of an Immersive Learning Environment

The Learning Sub-Platform provides diverse digital learning materials, including quizzes, video lectures, and real-time interactive content. Specifically, through Project-Based Learning (PBL) centered on solving community problems, learners can connect abstract knowledge to real social contexts. Furthermore, the AI-based personalized recommendation system analyzes learner preferences, achievement levels, and participation frequency to suggest optimal learning pathways.

All learning histories—such as time spent learning, content completion status, evaluation scores, and badge acquisition records—are recorded on the blockchain and utilized as foundational data for the learner's digital identity and lifelong learning record management. This structure, which assetifies records of active learning and growth beyond simple content consumption, offers transparency and self-direction that centralized learning platforms cannot provide.

5.8.2 Rewards Sub-Platform: Motivation Enhancement Through Value Actualization of Learning

The Rewards Sub-Platform issues immediate digital rewards to the learner, which are accumulated in a blockchain wallet. These rewards can be used both internally and externally on the platform, with primary uses including donation, purchase at the community store, exchange for digital content, bartering, remittance, and trading. This structure simultaneously expands learners' economic self-reliance and opportunities for social participation.

Unlike simple point accumulation, the reward system induces continuous participation through a value-reward structure directly linked to learning behavior. This technically overcomes the time-lag issue of rewards and the limitations of non-material motivation often overlooked in traditional education systems, supporting the realization of inclusive learning rights.

5.8.3 Significance of the Integrated Platform Structure

The two sub-platforms form a cyclical structure of **“Learning → Reward → Real-Life Utilization,”** connecting the process and results of education to practical social participation. Users do not merely acquire knowledge; they can convert its results into real-time social and economic value. This is an attempt to reconfigure education from the traditional view of it as merely an 'investment for the future' into a form of **active capital** available in the present.

Ultimately, NodajiFi presents the potential to respond to the dual challenge of resolving global educational inequality and fostering future talent by integrating guaranteed participation through digital technology, the socialization of practical educational value, and the social recognition of individual competency growth.

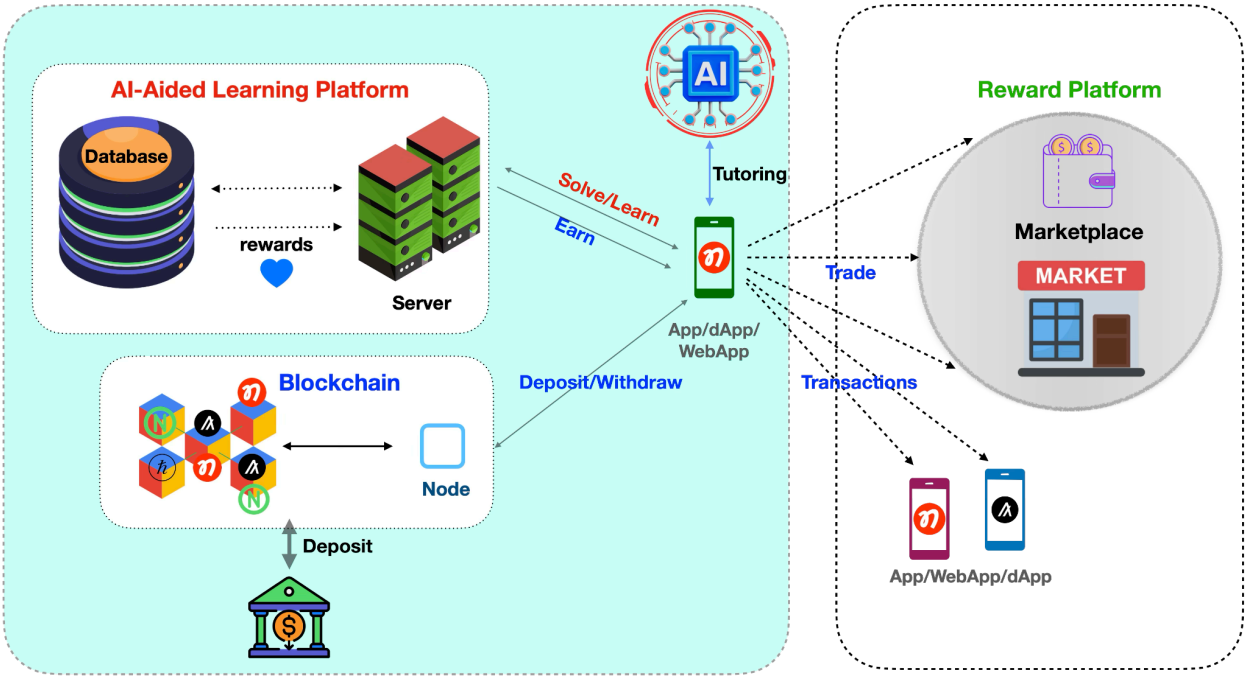

Figure 3: NodajiFi Learning and Reward Platform Architecture

5.9 Empirical Study and Evaluation Framework

NodajiFi proposes the following empirical framework to verify the policy feasibility and actual effectiveness of its approach:

<Table 4> Objectives for Empirical Study

Target Item	Description
Target Region Selection	Countries and regions with high educational marginalization (e.g., Sub-Saharan Africa, South Asian rural areas, etc.)
Participant Composition	School-aged youth and young adults (10–24 years), teachers, and NGO activists included.
Experimental Group Composition	Comparison between users of the NodajiFi reward-based learning platform vs. users of traditional online learning platforms.
Measurement Indicators	Learning persistence rate, assignment completion rate, academic achievement, digital literacy, token usage patterns, satisfaction.
Data Collection Method	Log data, surveys, interviews, token usage tracking analysis.
Observation Period	Short-term (3 months), medium-term (6–12 months), and long-term (24 months or more) observation.

Furthermore, in cooperation with international organizations, the framework includes establishing an official certification system, analyzing the long-term motivational effects of reward-based learning, and conducting a Cost-Benefit Analysis (CBA) to provide evidence for policy recommendations.

5.10 Summary and Implications

NodajiFi presents an educational inequality alleviation strategy that differentiates itself from traditional educational platforms based on the following four core pillars:

1. A reward structure connecting learning and economics.
2. An immersive learning environment based on gamification.

3. Transparent learning history management based on Blockchain.
4. Technological inclusivity centered on mobile and real-life utility.

In particular, for learners in environments where education is easily interrupted, NodajiFi presents the message that **"Learning is directly connected to survival,"** implementing an ecosystem-based comprehensive learning model that goes beyond simple access to information. In the future, NodajiFi can evolve into a hybrid platform integrating education, finance, welfare, and community, suggesting a turning point for resolving educational inequality and serving as a strategic reference for international development cooperation.

Chapter 6. Conclusion

6.1 Summary of Research Findings

This study comprehensively examined the status and causes of global educational inequality and proposed the concept and implementation strategy of a reward-based learning platform as a solution. It was confirmed that educational inequality still leaves over 200 million children and adolescents out of school globally, with the problem being particularly severe in low-income regions and among vulnerable populations. Economic poverty, social discrimination, and the digital divide interact complexly to cause educational gaps, a situation exacerbated by crises such as the COVID-19 pandemic.

Against this backdrop, there was a recognition that in addition to traditional efforts like expanding ODA and improving educational systems, a new approach based on technology and innovation is necessary, leading to a focus on reward systems that motivate learners and sustain their participation. The reward-based learning platform is an approach that leverages immediate incentives for learning to increase the educational participation of students from vulnerable groups, while implementing

personalized learning support and fair reward management through technologies like AI and Blockchain. The potential effects of this approach can be summarized as follows:

First, regarding strengthening learning motivation, several cases confirmed that combining gamification elements with rewards can significantly improve learner participation rates and assignment completion rates. This suggests that small, immediate rewards play a positive reinforcing role in boosting the will to continue studying, especially for students facing difficult environments. **Second, regarding expanding accessibility**, it was discussed that online platforms and mobile technology can provide educational resources beyond geographical limitations and can be designed inclusively to mitigate the digital divide through support for low-cost devices and offline functionality. **Third, regarding enhancing learning quality**, it was demonstrated that personalized learning via AI and immersive experience via VR/AR can increase the learning effectiveness of individual students and reduce disparities in educational quality stemming from a lack of physical resources. **Fourth, in terms of collaborative governance**, the PPP model—involving cooperation among government, international organizations, the private sector, and local communities—was confirmed to be crucial for the successful operation of such platforms, with actual cases emerging. Ecosystems involving multiple stakeholders, such as the Yoma Project, confirm that the combination of technological innovation and social support can make a substantial contribution to alleviating educational inequality.

It can be concluded that the reward-based learning platform holds academic and practical significance as a promising solution to the problem of educational inequality. It complements the limitations of the traditional school education model and represents a new paradigm by directly enabling marginalized learners to experience the "value of learning," thereby motivating their participation in education.

6.2 Significance and Limitations of the Study

The significance of this study is twofold:

First, by examining the problem of educational inequality through the lens of technological approaches, this study has provided a concrete direction for educational reform discourse in the era of the Fourth Industrial Revolution. Discussions on reducing educational gaps have often been confined to traditional means such as financial aid or teacher deployment. This study systematically addressed a relatively new concept: reward-based learning utilizing cutting-edge technologies like AI, Blockchain, and the Metaverse. This is significant in that it explores innovation applicable to the education sector within a rapidly changing technological environment and seeks a direction for future-oriented educational policy.

Second, the study attempted to connect theory with practice through literature review and case analysis. By citing various international statistics and research findings, the reliability of the discussion was enhanced, and specific examples from real projects, such as Yoma, were cited to illustrate how theoretical concepts can be realized in practice. This can serve as a valuable reference for practitioners planning similar initiatives in the future.

Third, the study emphasized the importance of multilateral cooperation in bridging educational gaps and proposed concrete cooperation models, thus offering implications for policy formulation in this field. Since technological solutions require human and organizational action to be effective, the inclusion of diverse partnership strategies adds value to this research.

However, this study also has several limitations. **1) Durability of Motivation:** Although positive examples were introduced regarding the empirical effects of reward-based learning platforms, further rigorous research is needed on whether this approach guarantees long-term sustainable motivation. For example, while rewards may increase participation in the short term, there is a concern that their effect may diminish over time due to familiarity or fatigue. Furthermore, given the educational psychology debate concerning intrinsic vs. extrinsic motivation, the caveat that extrinsic rewards can actually hinder intrinsic motivation requires further research on achieving a balance between the two. **2) Practical Constraints of Infrastructure:** The realistic

limitations concerning technological infrastructure cannot be ignored. Billions of people worldwide still lack stable internet or electricity, let alone VR devices or modern smartphones. In this context, the advanced technology utilization proposals presented here may appear idealistic and difficult to implement comprehensively in the short term. A gradual, hybrid approach (e.g., combining offline reward systems with online platforms) is necessary for actual application, and the study is limited by its failure to present a concrete roadmap for this. **3) Cultural Receptivity:** Responses to rewards or attitudes toward technology adoption can vary significantly across cultures. For example, some educational philosophies emphasize the intrinsic value of learning "for its own sake," potentially viewing an excessive reward system with suspicion. While this study highlighted the advantages of a reward-based approach, it is also a limitation that critical perspectives or ethical issues (such as data privacy and algorithmic bias) were not sufficiently discussed. Finally, a lack of quantitative data analysis meant that the magnitude of the effect or the cost-effectiveness of the proposed solutions could not be clearly presented; this needs to be addressed through future pilot program evaluations or cost-benefit analyses.

Despite these limitations, this study offers new ideas for educational policy and EdTech development by exploring the intersection of technology and educational inequality. In particular, the perspective of stimulating learning motivation through a digital reward system is considered valuable for future in-depth research and experimental validation.

6.3 Policy and Practical Recommendations

To realize the approach of a reward-based learning platform for alleviating educational inequality, the following policy and practical recommendations are offered:

Active Government Support and Institutionalization: National governments must significantly scale up infrastructure investment to reduce the digital education divide. Priority should be given to improving internet connectivity down to the school and village level, and setting a medium-to-long-term goal for one digital device per student. Institutional innovation should be sought by establishing national education platforms

that integrate verified open content and reward systems, and by treating the certification of learning history from platform usage as a supplementary means of official academic accreditation. For instance, motivation can be provided by partially reflecting online platform completion results in GED exams or alternative academic certifications. Furthermore, legal and institutional frameworks must be established to safely manage student learning data and reward information and protect privacy by establishing educational data governance.

Strategic Utilization of International Solidarity and ODA: Since educational inequality requires a collective international response, developed countries must strive to increase their education-sector ODA and allocate its use to more innovative programs. It is recommended that ODA funds be invested not only in traditional infrastructure construction but also in the development and dissemination of reward-based learning platforms discussed in this paper. Specifically, this could involve projects managed by UNESCO or UNICEF to develop global standard platforms and localize/deliver them to various countries, training teachers in gamification and AI utilization, and establishing school internet subsidy funds linked to the GIGA initiative. Furthermore, it is proposed that an international organization-led Education Innovation Fund be established to support creative projects by EdTech start-ups or NGOs, serving as a proving ground for expansion if proven effective.

Diffusion of Public-Private Partnership (PPP) Models: A matching platform is necessary to link corporate social responsibility and impact investment trends with efforts to eliminate educational inequality. This platform should be mediated by governments or international organizations, connecting companies possessing technology and capital with NGOs or local organizations that deeply understand the challenges in the field. This creates a win-win structure where companies achieve both social contribution and new market exploration, while society reaps the public benefit of reduced educational inequality. For example, cooperation is possible where a major telecommunications company provides free internet and tablets to rural schools, and a local NGO provides academic guidance and mentoring to the students. Universities and research institutions can also participate to measure and analyze the effects of such

projects and provide feedback. Collaboration with open-source communities to develop and share low-cost educational technology solutions is also proposed.

Capacity Building for On-site Teachers and Learners: No matter how good the platform and reward system, they cannot be effective if the capacity of the teachers and students utilizing them is insufficient. Therefore, teacher training programs must include digital pedagogy and learning coaching techniques so that teachers can learn how to integrate reward-based online learning into their classes and manage learner motivation. Students also need to receive digital literacy education to develop the ability to plan, execute, and manage their own online learning time. In particular, basic education on "how to learn online" for vulnerable students lacking self-directed learning experience should precede platform utilization to enhance its effectiveness. Moreover, efforts to raise awareness among parents and the local community are important, as stable support environments for students depend on the correct understanding and endorsement of reward-based learning.

Continuous Monitoring and Improvement: Finally, any introduced policies and programs must be subject to continuous evaluation and improvement processes. Educational status data and platform utilization data must be monitored to ascertain where gaps are being reduced and where problems persist. By disaggregating performance indicators by gender, region, and income group, necessary revisions can be made if a particular group shows insufficient results. Given that technology evolves rapidly, flexibility is also required to update programs according to new tools or trends (e.g., AI advancements, increased Metaverse use). Educational policies will gradually mature and become more effective when a learning policy process is in place that shares the results of policy experiments domestically and internationally for mutual learning and development.

6.4 Fulfilling the Promise: Rewards Follow Learning

Global educational inequality remains an unresolved challenge for all humanity, but it is by no means an immutable law. Over the past several decades, the international community has significantly improved primary school enrollment rates through

cooperation, and now stands at a juncture requiring a qualitative leap to secure learning continuity, effectiveness, and inclusivity, moving beyond mere access.

At this transition point, this study explored how innovative strategies utilizing reward-based learning platforms and digital technology can contribute to resolving educational inequality. The **NodajiFi** platform presented in this paper is particularly noteworthy as a next-generation global learning platform currently undergoing actual implementation, rather than remaining a mere conceptual model. The worldwide service launch is scheduled for **January 2026**, actualizing its applicability in real educational settings.

NodajiFi is based on the philosophy of **“Learn & Earn,”** integrally implementing motivation design for learning, an immersive experience-based learning structure, a Blockchain-based learning certification and token reward system, and technological accessibility considerations for low-specification environments. This structure addresses the limitations of existing global education platforms—such as the absence of rewards, lack of real-world connection, and technology/language barriers—and suggests the potential for substantial contribution to enhancing the participation and persistence of marginalized learners.

Notably, **Benjamin Bloom's "The 2 Sigma Problem,"** published in 1984, left a crucial insight for the field of education. He reported that students receiving one-on-one tutoring achieved an average performance two standard deviations (2σ) higher than those in conventional group instruction (equivalent to the top 2%). This provided strong evidence that personalized, customized learning is far more effective than group instruction. However, at that time, realizing this on a large scale was unfeasible due to high costs and infrastructure shortages.

Now, however, the development of AI technology makes it possible to provide learning paths and real-time feedback nearly equivalent to 1:1 tutoring. By practically integrating this technology into education, NodajiFi presents a new possibility for resolving the **2 Sigma Problem** raised by Bloom. This can be seen as a turning point

capable of narrowing the structural gap in learning outcomes, going beyond mere technological implementation.

Moreover, the platform secures governance and sustainability for the platform itself by distributively rewarding not only learners but also content creators, reviewers, and community participants through the concept of a **DAO (Decentralized Autonomous Organization)**.

Most importantly, commitment and execution are vital. Resolving educational inequality is not a problem solvable in the short term; substantial change is possible only with continuous investment, technological innovation, and inclusive cooperation from the international community. NodajiFi aims to be the starting point for this change, and its significance is amplified by t he fact that it is a platform currently being implemented, not just a suggestion. When all children and youth worldwide are guaranteed educational opportunities to realize their potential, this will lead to the sustainable prosperity of all humanity, going beyond individual achievement. The technological approaches and policy executions we choose today will determine the equitable educational environment for future generations. Therefore, the actions taken now are the most crucial seeds of change, paving the way to fulfilling the promise that **“rewards follow learning.”**

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