Demonstration Experiment of Decentralized Learning Within Traditional Decentralized Education

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Keywords: Decentralized Learning, Decentralized Architecture, Microcredential, Microlearning, Digital Badge.

Abstract: Modern decentralized learning aims to promote free and open education by building learning networks and facilitating independent learning activities among relatively small, spontaneously formed communities outside of schools. Traditional decentralized education, meanwhile, refers to the transfer of authority over education systems from the central government to local authorities. Traditional decentralized education is also commonly understood as integral to realizing a sustainable society. However, traditional decentralized education also faces significant challenges, such as financial difficulties and a lack of motivation among educators and learners. We propose a framework for incorporating a modern decentralized learning approach that incorporates digital badges, microlearning, and microcredentialing into traditional decentralized education systems in order to eliminate the obstacles presented by traditional decentralized education. This study also identifies the advantages and disadvantages of the proposed framework by conducting an empirical experiment in which teacher training under decentralized education is implemented through online-based decentralized learning, positioned as a learning community for teachers working in local government schools.

1 INTRODUCTION

In the modern decentralized learning approach to education, learners assist each other and share learning experiences within small communities (Hori, 2018). In traditional formal education, by comparison, students learn in a centralized manner, gathering in a school and obtaining knowledge from a teacher. Compared with centralized education, decentralized learning improves the quality of education, enhances the satisfaction experienced by learners, enables education tailored to individual needs and community characteristics, and facilitates the rapid adaptation of teaching methods to social and environmental changes.

Traditional decentralized education first emerged in developing countries in the 1980s following the transfer of the management of education services from central to local governments with the goal of improving fiscal efficiency. The traditional decentralized approach not only generates economic benefits but also promotes the democratization of education.

Both modern decentralized learning and traditional decentralized education have their own challenges. Although many proposals regarding decentralized learning began appearing in approximately 2008 and then continued throughout the 2010s, there have been few practical successes. Indeed, a clear gap exists between proposed theories and real-world applications. Traditional decentralized education advocates fiscal efficiency and the democratization of education. Moreover, although authority has been transferred from central to local governments, the educational effects still need to be fully realized.

Another problem common to both modern decentralized learning and traditional decentralized education is that, due to the lack of a centralized infrastructure, it is difficult to maintain a standardized

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Hori, M., Ono, S. and Miyashita, K.
Demonstration Experiment of Decentralized Learning Within Traditional Decentralized Education.
DOI: 10.5220/0012723600003693

In *Proceedings of the 16th International Conference on Computer Supported Education (CSEDU 2024) - Volume 1*, pages 216-226
ISBN: 978-989-758-697-2; ISSN: 2184-5026

quality of education across various local school districts.

Our ultimate aim is to realize flexible and agile lifelong learning by introducing decentralized learning into traditional decentralized education. This study reports a preliminary demonstration experiment in the achievement of this goal.

The study's demonstration experiment shows that integrating modern decentralized learning methods into traditional decentralized education approaches can solve problems facing both traditional decentralized education and modern decentralized learning. This experiment focuses on training primary and secondary teachers in local governments in Japan. Teacher training has become indispensable for local governments seeking to respond to the diversifying educational needs that have emerged due to rapid social changes. However, despite the urgent need to implement unique teacher training programs at the local government and school levels, this responsibility has been delegated to local education offices. Modern decentralized learning provides flexible options for teacher training, as its diversity of methods can facilitate quick responses to social changes while also respecting the autonomy of participants.

The study understands local governments as decentralized learning communities. Moreover, we present a model of modern decentralized learning that combines digital badges and microlearning to improve teachers' skills and visualize their achievements. We also conducted an empirical experiment to apply this modern decentralized learning approach, which guarantees the quality of learning through microcredentialing, to a real-world scenario and evaluated the resulting challenges. This empirical experiment will be conducted in three stages.

Table 1 reports the results of the first stage.

Table 1: Experimental stage.

Stage	Year	Target	Training Institute
1	2023	Two municipalities	One institution of higher education
2	2024	Three municipalities	Two institutions of higher education
3	2025	More than five municipalities	More than three institutions of higher education

By conducting these demonstration experiments using the specified framework, we intend to clarify how decentralized architectures can benefit traditional decentralized education. We also outline the advantages and disadvantages of this approach.

This paper is divided into ten sections. The second through fourth sections overview traditional decentralized education, modern decentralized learning, and their challenges to provide background for the experiment. The fifth section outlines the digital badges, microcredentials, and micro-learning used in the demonstration experiment. The sixth section overviews the experiment, and the seventh presents the results. The eighth through tenth sections discuss the results and conclusions.

2 TRADITIONAL DECENTRALIZED EDUCATION

Traditional decentralized education was initially introduced in the 1980s with the objective of reducing federal spending on education and welfare and also promoting the establishment of a democratic system. This transition was part of structural adjustments carried out under the guidance of the International Monetary Fund (IMF) and the World Bank during the implementation of a debt relief plan meant to alleviate debt burdens. The policy was intended to decentralize primary and secondary education by granting local municipalities—which had formerly been controlled by the central government—increased authority over education policy. This shift had significant political implications. Moreover, as outlined by Hanson (1997), the policy also stated the anticipated benefits of introducing a decentralization education system:

1) Improvement in management efficiency and capacity through the introduction of market principles
2) Neutralization of teachers' unions and political parties
3) Education not limited by existing schools
4) Improvement in education quality caused by improvements in teachers' skills and the procurement of appropriate teaching materials
5) The establishment of an environment for continuous learning through community involvement

Ensuring the effectiveness of a decentralized architecture for traditional decentralized education also requires addressing contemporary issues, such as skills development for teachers and community involvement.

Management scholar Peter Drucker noted that there were limits to the effectiveness of schooling and that the best example of education was the literacy movement promoted by Mao Zedong during the Cultural Revolution (Drucker, 1998). During the literacy movement, students who learned to read taught other students the characters they had learned, thereby enabling students to teach other students without relying on schools. This movement led to a considerable increase in the literacy rate in China in a short period of time. This success story can be applied to the use of modern internet technologies for the teaching of more advanced information.

However, examples of best practices are exceptions within traditional decentralized education, which, despite significant expense and effort, has yet to produce substantial global results (Hanson, 1998).

3 MODERN DECENTRALIZED LEARNING

The emergence of blockchain and distributed ledger technologies has catalyzed the development of various forms of decentralized architectures, including societal, organizational, and infrastructural architectures. Among these, decentralized learning systems constitute a significant innovation, and they contrast sharply with the centralized educational models that have dominated since the 18th century.

Paul Baran introduced the notion of “decentralized networks” as intermediary systems connecting centralized and distributed systems (Baran, 1964). With the advent of blockchain technology, the concept of decentralized networks expanded to accommodate the broader societal shift toward decentralization, challenging established centralized social structures.

Decentralized learning, in particular, has garnered attention because of its potential to revolutionize how knowledge is disseminated and acquired (Tapscott, 2019). This paradigm proposes a shift from traditional, school-centric learning to efficient online education that is accessible to all. For example, the “Learning is Earning 2026” campaign developed by the Institute for the Future exemplifies this approach by using blockchain technology to incentivize individual and communal learning. This approach parallels the literacy campaigns of the Cultural Revolution yet adds a modern technological interpretation that employs virtual currency.

Despite the promising prospects of decentralized architecture, its practical applications have been limited to virtual currencies, such as Bitcoin and Ethereum. This sluggish transition to real-world uptake can be attributed to several challenges:

In educational environments, the volatility of virtual currencies often leads to instability and financial failure. Persistent financial difficulties faced by communities championing decentralized learning hinder their ability to offer a supportive learning environment. The localized nature of these educational models increases the complexity of assessing and validating the quality of educational outcomes. Therefore, the visibility and credibility of these models need to be enhanced for external observers.

This analysis underscores the need for robust mechanisms for validating and accrediting learning achievements within decentralized learning frameworks to ensure that they can obtain the level of social trust and recognition necessary for broader acceptance and implementation.

4 INTEGRATING MODERN DECENTRALIZED LEARNING INTO TRADITIONAL SETTINGS

This study introduces modern decentralized learning to traditional decentralized education settings. We hypothesize that this will simultaneously solve the problems facing both modern decentralized learning and traditional decentralized education, which we intend to demonstrate through an empirical experiment.

Traditional decentralized education was initially intended to grant local governments increased authority over education-related decisions. However, there are limits to what local governments can achieve independently due to their limited financial and human resources while still ensuring the provision of quality education. It is difficult to identify successful examples of traditional decentralized education, even when assuming a global perspective and considering initiatives led by international organizations such as the World Bank and the United Nations.

Modern decentralized learning, meanwhile, is based on the premise that learning networks are constructed within each community. According to this framework, individual communities can encourage autonomous approaches to learning. To motivate learners, decentralized architecture can be employed to visualize learning results, and tutors can provide learners with support. Indeed, within decentralized architectures, communities become network nodes that communicate with each other.

Traditional decentralized education can be enhanced if the online education system can be structured to support such autonomous efforts.

In this context, this study seeks to bring the benefits of modern decentralized learning to traditional decentralized education models by introducing technologies such as microlearning, digital badges, and microcredentialing to online education environments.

5 ONLINE TOOLS FOR MODERN DECENTRALIZED LEARNING

5.1 Digital Badges

In the evolving framework of digital badges used for decentralized education, the role of community support is increasingly critical. Among various innovations in this domain, the "open badges" concept represents a pioneering effort to digitally quantify and visualize learning achievements (Jovanovic, 2014). This system is particularly notable because (1) it enables badges to be issued by anyone, and (2) it incorporates an endorsement mechanism to authenticate each badge. The first feature democratizes the badge issuance process, facilitating a shift away from traditional, centralized educational systems, while the second feature ensures that the community can trust the value of the learning achievement signified by the badge.

Crucially, the use of blockchain technology to facilitate learning achievement badges represents a third crucial feature of this system. This innovative approach was spearheaded by the "Learning is Earning 2026" initiative developed by the Internet Engineering Task Force, which aims to leverage blockchain technology to facilitate the distribution and verification of learning achievements. This technology promises to enhance the reliability, transparency, and accessibility of educational credentials, marking a significant advance in how educational achievements are recognized and valued in decentralized learning ecosystems.

5.2 Microlearning

To adapt to the evolving landscape of decentralized education, traditional time-intensive learning methods—such as those found in classroom settings—must be made more practical. In today's fast-paced world, where individuals are constantly engaged with work and other commitments, there is a pressing need for models of education that can accommodate the brief interludes of free time that individuals experience throughout their day. This approach would enable learners to gradually build a cohesive body of knowledge through short, intermittent study sessions. This mode of knowledge acquisition is known as microlearning (Gassler, 2004).

Two critical technological requirements underpin microlearning. The first involves the creation of a vast array of learning materials that are concise and focused on specific topics; these are referred to as "microcontent." The second necessity is a mechanism for efficiently locating and compiling this microcontent into curricula tailored to the learner's needs, ensuring that the content is relevant and comprehensive.

5.3 Microcredentials

Under a modern decentralized learning paradigm, established authorities will not be the only entities that can validate learning outcomes. That is, despite not being able to grant formal degrees or certificates, communities will be able to issue digital badges for reaching microlearning milestones and completing small-scale educational units. Ensuring the quality of learning outcomes is essential, which emphasizes the importance of properly managing credentials (Gish-Lieberman, 2021).

Microcredentials have emerged as a solution to these verification issues. Indeed, microcredentialing has been adopted by over 150 countries worldwide, including European countries, the United States, South Africa, and countries of the Asia-Pacific regions, as well as by organizations such as UNESCO and the OECD. Despite this widespread adoption, there is still no consensus regarding the best microcredentialing practices and the scope of appropriate applications for microcredentialing. These initiatives all share a common goal: to achieve quality assurance by implementing some form of qualification framework (QFs).

Microcredentials are designed within QFs that stipulate specific competencies that must be met for quality assurance purposes. Maintaining high-quality QFs and competencies across numerous credentials is a formidable task.

The variety of approaches to microcredentialing reflects the broad recognition of its potential benefits; nevertheless, its practical applications and societal value are yet to be fully realized.

6 SYSTEM CONFIGURATION OF THE DEMONSTRATION EXPERIMENT

6.1 Pilot System

Figure 1 outlines the system structure developed for the demonstration experiment. The figure illustrates an educational strategy that incorporates short video-based sessions and tasks—each of which is designed to be completed within approximately 10 minutes—into individual learning modules. After the completion of each module, learners are awarded digital badges.

In the pilot system framework, these digital badges, when submitted to local boards of education, serve as evidence of having completed the required training programs. Local boards of education are responsible for managing elementary and secondary education teachers within each local municipality in Japan. Therefore, the experiment supports microcredentialing by issuing and validating digital badges.

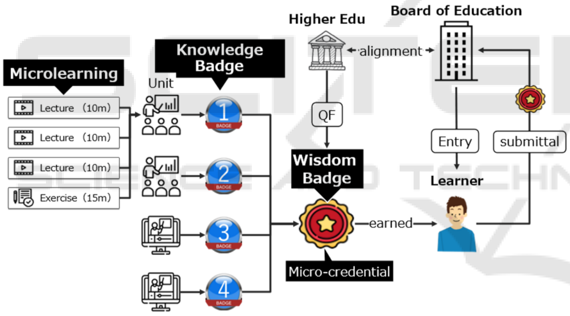


Figure 1: Overview of the pilot system.

6.2 Realization of Microlearning

The structure of the pilot microlearning program is shown in Figure 2. Microlearning programs that are approximately 10 to 15 minutes in length and consist of videos with synthetic audio are bundled together as lecture units, and a digital badge is issued upon completion of each program. In the pilot system, this badge is referred to as a "Knowledge Badge." After attending ten credits worth of lectures and passing a final test, students are awarded a digital badge. This badge is referred to as a "Wisdom Badge."

6.2.1 Content Creation

Creating small-scale, granular learning content for microlearning presents practical challenges. Most faculty members at Japanese universities are accustomed to delivering lectures that last 90 to 100 minutes. Indeed, they may dismiss the concept of microlearning and, therefore, require opportunities to become familiar with this new format. Nonetheless, in traditional lectures, one slide is typically prepared for each lecture; this approach became a focal point of our microlearning initiative.

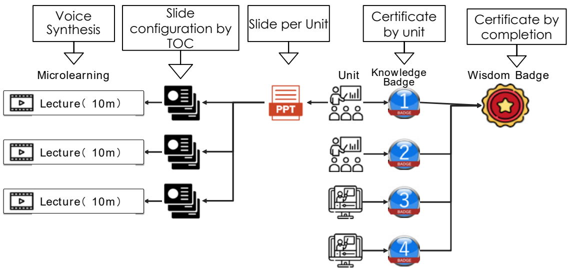


Figure 2: Microlearning structure.

Initially, we informed university instructors that the criterion for awarding the Knowledge Badge was attending one standard lecture and completing the wisdom badge course. Subsequently, we requested that instructors develop slides and corresponding tables of content for each lecture.

The slides were then segmented by the individual responsible for developing the educational materials based on the table of contents. These segments were transformed into videos that could be viewed in approximately 10 to 15 minutes. Table 2 summarizes the pilot system approach to microlearning.

Table 2: Microlearning concept.

Unit	Approximate study time	Mode of thinking.
Wisdom Badge	1–6 hours	This corresponds to the certificate of completion for a conventional course. This training course is a microcredential because it is an accredited unit of training.
Knowledge Badge	60–90 minutes	It is equivalent to a certificate for completing one traditional university lecture course. In practice, this is the minimum granularity of badges awarded for completing a microlearning unit.
Microlearning	Approx. 15 min	Lecture videos that summarize the learning content in 15 minutes or less. They offer flexibility by changing the conditions for issuing badges of competence.

6.2.2 Standardization of Content

The pilot system uses concise video content, with each segment lasting approximately 10 to 15 minutes. Videos are created according to specific standards to enable the flexible combination of video segments to assemble various courses.

1) All video content is uniformly licensed under a Creative Commons license.
2) Instead of human narration, a consistent artificially generated voice is employed across all videos.
3) Videos are cataloged and shared through the video management platform on the pilot system.

6.2.3 Creative Commons Licensing

The training materials provided by the pilot system are offered as open educational resources that are accessible to anyone. As such, the entity overseeing the pilot initiative is accountable for any potential risks that may arise. To mitigate personal risks while safeguarding creators' interests, it is recommended to identify content as belonging to the organization to which the faculty member belongs, clarify the identity of the copyright holder, and recognize individual faculty members as contributors. Creators' interests include maintaining their social reputation and trustworthiness while also being recognized for their contributions to education and research. Additionally, the organization can alleviate any potential disadvantages for faculty members by allowing them the right to commercially utilize derivatives of their work irrespective of Creative Commons stipulations. Therefore, a standardized Creative Commons license would cover content disseminated through the pilot system.

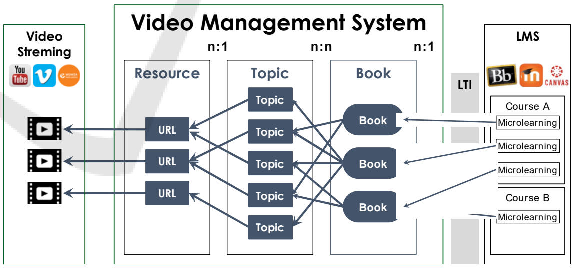
6.2.4 Dvancements in Learning Using Voice-Synthesized Slides

In order to facilitate microlearning integration, the pilot system incorporates speech synthesis technology. Instructional content designed to be completed within approximately 10 to 15 minutes is delivered through presentations using Microsoft® PowerPoint®, a trademarked product of Microsoft Corporation. These presentations will feature a uniform design and be accompanied by synthesized voiceovers generated from scripts provided by the university faculty. The result, designated as "speech-synthesized slides" within the pilot system, ensures a consistent format across all instructional videos to facilitate the seamless integration of video segments into comprehensive training modules regardless of the instructor's identity. Moreover, this approach streamlines the process of updating material; modifications, such as changes to slides or scripts, can be efficiently implemented, even when there is a change in faculty, thus ensuring ease of content management.

The pilot system employs an open-source voice synthesis platform to create these text-to-speech video slides. This platform converts text from the notes sections of Microsoft® PowerPoint® slides into synthesized speech, resulting in an educational video slide. By offering this platform as open-source software (OSS), the pilot system reflects a commitment to enhancing the accessibility and adaptability of educational resources. This initiative highlights the innovative use of technology in education and fosters a collaborative environment where anyone can contribute to or modify the platform.

6.2.5 Video Management System

This OSS initiative led to the development of a video management system designed to enhance open online learning. This system was created through a collaborative effort involving the National Institute of Informatics at Osaka University, Kumamoto University, and the non-profit organization Cyber Campus Consortium TIES. The system is openly accessible on GitHub under an OSS license (ChiBi-CHiLO, 2023). The architecture of the system is illustrated in Figure 3.



https://github.com/npocccties/chibichilo

Figure 3: Video management system diagram.

The video management system organizes video content according to three hierarchical levels—resources, topics, and books—with books representing the highest level of organization. These books can be integrated with learning management systems (LMSs) using the learning tools interoperability standard.

Within the pilot system framework, a book at the highest level consists of a 10- to 15-minute video consisting of speech-synthesized slides. Topics correspond to individual slide pages, and the baselevel resources are URLs to the video streaming system. This hierarchical structure facilitates efficient management and the updating of the video content for each slide. Moreover, the video management system supports the sharing and reusing of resources, topics, and books, enabling the provision of content in various combinations.

6.3 Open Badges

The pilot system uses OBv2.1, which consists of three components: Assertion, BadgeClass, and Issuer Profile (Ahn, 2014). Assertion describes the attributes of the badge acquirer, and Issuer Profile describes the attributes of the badge issuer. BadgeClass refers to the template data for each badge; it is included in all issued badges and is publicly available for reference by third parties. The BadgeClass for the Wisdom Badge contains the ID of the Knowledge Badge that is required to earn the Wisdom Badge. The BadgeClass for the Knowledge Badge contains the ID of the microlearning that is required to earn the Knowledge Badge. Therefore, each badge is able to verify the learning content associated with it and the conditions under which it was awarded.

In this way, the badges visualize learning results and can be used both for self-reflection and as proof of the completion of training.

6.4 Faculty Development Metrics for Microcredentials

Each local board of education in Japan is required to maintain its own set of criteria for teacher development. These criteria provide a detailed framework of the skills and competencies that elementary and secondary school teachers must develop depending on their career level. Meanwhile, this framework also provides an overview of a teacher's entire professional trajectory. This approach embodies the principles of QFs by promoting learning tailored to different stages of a teacher's career. It also emphasizes competencies by specifying the attributes and skills that should be cultivated. The teacher development metrics are tailored to reflect local needs. Boards of education at the prefectural and municipal levels are expected to independently manage teachers' continuous learning, beginning with their initial training and extending throughout their careers. Many boards of education have initiated such programs in collaboration with local institutions that support teacher education. Therefore, the foundational elements necessary for implementing microcredentials are already in place.

To ensure the quality of online educational offerings and facilitate teachers' access to structured training based on their self-identified needs, this pilot program aligns competency badges with the teacher development standards established by local boards of education, which recognize this program as an accredited form of professional development.

6.5 Implementation of the Pilot System

The pilot system consisted of a portal system, a LMS, and a video management system (Figure 4). The LMS was provided by Moodle®. Moreover, Moodle® functions were also used to offer courses and issue digital badges.

The portal system was developed independently. The portal system imports BadgeClass, a digital badge issued by Moodle®, and implements a function to map courses to the teacher development index. A search function was also implemented to allow learners to search for badges they wish to acquire based on the structure of ability badges and Knowledge Badges described in the imported BadgeClass and the microlearning content included in the Knowledge Badges.

In developing the portal system, OpenJS Foundation's node.js framework was used as the backend, and Meta's React™ component was used as the frontend.

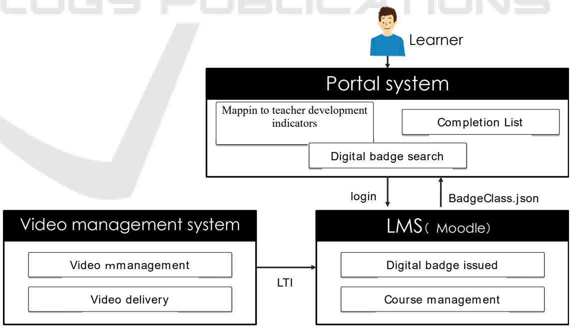


Figure 4: Implementation of the pilot system.

7 DEMONSTRATION EXPERIMENT

7.1 Subjects of the Demonstration Experiment in This Study

Japanese teachers are known to allocate significantly less time to self-study than their counterparts in OECD countries (Ainley, 2018). Additionally, the results indicate that Japanese teachers need to improve their IT skills.

However, one factor contributing to this situation is the long working hours that restrict Japanese teachers' study time and hinder their learning capacity, even if they are willing to study and improve their skills. Although teacher training is mandatory for Japanese educators, much training is conducted face-to-face, demanding considerable time commitment from teachers and contributing to their extended working hours.

The significance of decentralized learning lies in its potential to enable teachers to learn anytime and anywhere, thereby sustaining their motivation for learning. Evaluating the effectiveness of decentralized learning can illuminate its importance. Moreover, such evaluation can provide insights into enhancing online education by creating an accessible learning environment for students, regardless of their IT proficiency.

If decentralized learning proves effective within this context, it holds promise for facilitating lifelong learning, particularly for individuals with time constraints or those pursuing multidisciplinary professions, both within Japan and globally.

7.2 Experimental Method

The demonstration experiment was conducted for five months, from August 1, 2022, to January 10, 2023, with the cooperation of a local government in Japan (Hori, 2023). The target learners (approx. 360 people) were teachers eligible for a training program to improve their qualifications as mid-career teachers at elementary and secondary educational institutions within the target municipality. Mid-career teachers who are expected to play a core role must attend a training program to improve their qualifications. The competency badges obtained through the pilot system can be used for face-to-face training in this demonstration experiment.

The training courses, or Wisdom Badges, prepared for the demonstration experiment consisted of 15 types. Teachers registered themselves as users of the pilot system, and they freely selected training courses. In addition, a final task, such as a multiple choice test, was prepared, and a Wisdom Badge was issued upon completion. Teachers are certified as mid-career teachers by submitting their Wisdom Badge using the report submission function of the training system operated by the local board of education.

7.3 Results of the Demonstration Experiment

Table 3: Status of participation in demonstration experiment.

Number of subjects	360*
Number of teachers (learners) (unique/total)	52/111
Number of people who have earned Wisdom Badges (unique/total)	26/53

7.3.1 Enrolment Status

Table 3 shows the enrolment status of the demonstration experiment.

Of the approximately 360 eligible participants, 52 (14.7%) took the course, and approximately half (26) of them obtained the Knowledge Badge as a badge of competence. In addition, some teachers took multiple courses and obtained multiple competence badges. Of the 52 teachers, 28 (54.9%) took only one course, and 24 (47.1%) took two or more courses (Figure 5).

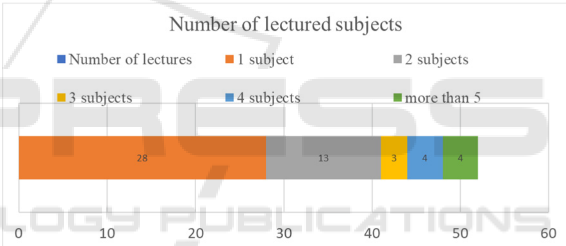


Figure 5: Number of courses taken by teachers.

Of the 52 teachers, about half, 26 (51.0%), earned at least one badge (Figure 6).

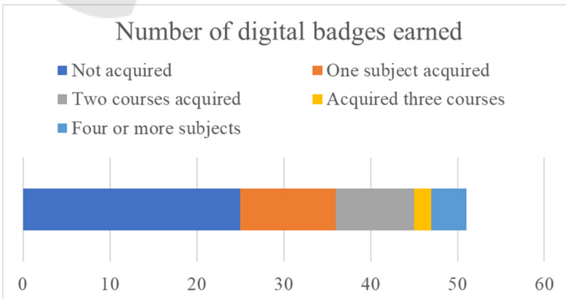


Figure 6: Number of badges earned by teachers.

7.3.2 Questionnaire Results

A questionnaire was sent to those who had obtained a competence badge upon completion of the course. The number of samples collected was 13. Figure 7

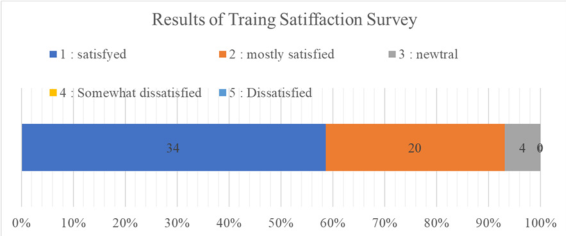


Figure 7: Training satisfaction.

shows the results of the questionnaire regarding satisfaction with the online training: In total, 83% of the faculty members stated they were "satisfied" or "mostly satisfied." Figure 8 shows the results of the questionnaire, which asked those who answered "satisfied" and "somewhat satisfied" (Figure 7) what they were satisfied with. The most common responses were that they were able to freely choose the course of their choice and that the video was easy to study because it was broken up into smaller segments.

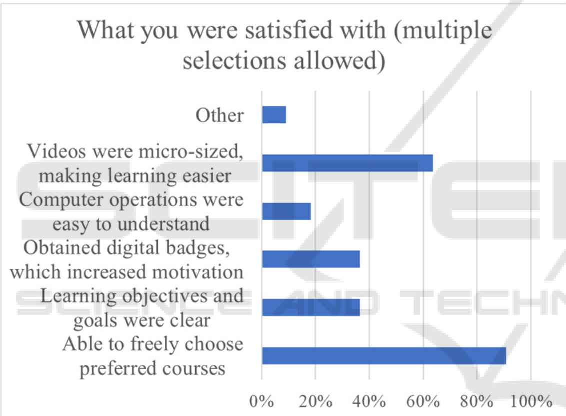


Figure 8: Factors of satisfaction.

Figure 9 shows the results of the questionnaire questions asking about barriers to attending teacher training. The number of samples collected were 13 from those who had obtained a competence badge upon course completion.

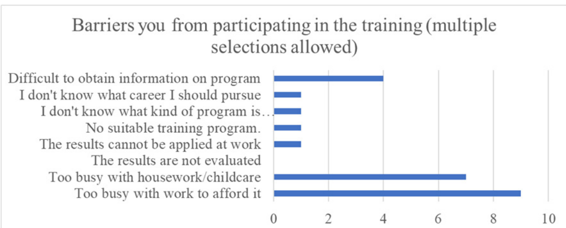


Figure 9: Factors hindering training.

The number of respondents who mentioned time constraints, such as "too busy with work" and "too busy with housework/childcare," is significantly higher than the other responses.

8 CONSIDERATIONS

Only the initial stage of this demonstration experiment has been completed, and therefore, it has produced limited data regarding the conditions under which decentralized learning can be applied. Despite these constraints, however, we have identified several challenges and prospects for decentralized learning.

8.1 Effects of Decentralized Education

This experiment revealed the distinct characteristics of decentralized education. The benefits of microlearning for individuals with busy schedules have been well documented in various empirical studies, and our survey results confirmed this. Additionally, the flexibility afforded learners when freely choosing courses also proved beneficial.

We also observed reduced administrative costs due to the adoption of digital badges. For training providers, digital badges eliminated the need to create participant lists and oversee a registration process. Furthermore, incorporating teacher development indicators into a QF facilitated quality assurance and exemplified microcredentialing. However, challenges persist regarding learner benefits, badge validation, and the diversity and quality of content.

8.2 Mechanism for Learners to Engage with the Qualification Framework

To enhance the quality of teaching, teachers must review their training history in alignment with teacher development indicators stipulated by a QF. They must objectively analyze the changes that they observe before and after attending training and develop a training plan that they pursue autonomously. Although we failed to provide such a mechanism in this experiment, the responses from our survey highlight the demand for autonomous training programs.

8.3 Badge Verification

In our demonstration experiment, a local board of education used the report submission feature of another training system owned by the local government for submitting digital badges. This system did not support verification of the authenticity of digital badges, and data transfer between systems was conducted manually. Developing a mechanism for importing digital badges into a training system owned by a local board of education after verifying their authenticity, as well as managing course histories in a unified manner, is an essential task for the future.

8.4 Content Diversity

In this demonstration experiment, training content was provided through a system operated and managed by an institution of higher education. However, we anticipate a significant increase in the number of users, and the capacity of institutions of higher education to provide training is limited. Therefore, establishing a system for offering diverse and quality-assured training programs in collaboration with other universities is necessary.

9 FUTURE PROSPECTS

Despite numerous endeavors in distributed learning, substantial breakthroughs are still required. Although considerable resources have been allocated to traditional decentralized education, notable achievements are still pending. This study addresses both issues by integrating decentralized learning into conventional decentralized education.

The primary objective is to demonstrate that decentralized learning can foster growth of diverse learning communities and facilitate adoption of varied learning methodologies that address learning needs and styles of all the stakeholders. Additionally, within the established framework of distributed education, we aim to establish a system that fosters creation of distributed learning communities and offers educators a spectrum of learning options.

Empirical validation of effectiveness of distributed learning marks the initial phase of accomplishment of our research .

Following the completion of the initial demonstration, we have entered the next stage of the experiment, with 31 training courses already underway. Furthermore, we are actively pursuing new developments.

9.1 Development of a Badge Wallet

Our team is currently working on a badge wallet system. This digital platform will enable learners to access and view their earned digital badges. It is designed to store these badges, providing learners with a concrete method of assessing their skill upgrades and competency developments, as outlined in the teacher development indices associated with each badge. This tool facilitates self-directed learning by allowing learners to assess their qualifications from a broader perspective and plan their education accordingly.

9.2 Development of the Badge Cabinet

We are creating a system known as the "badge cabinet." It is aimed at enhancing the value of digital badges beyond mere certificates. This system enables local boards of education to verify badges and efficiently organize extensive training records. With the badge cabinet system, students can present their digital badges to a local board of education, facilitating a board's ability to efficiently document training achievements within their training record systems, including personnel management systems. The application of the badge cabinet extends beyond this example. It can also serve as a centralized platform for managing diverse training programs, including both internal training sessions and programs offered by external entities, as long as they issue digital badges.

9.3 Enhancement of Training Programs

Our objectives include establishing guidelines to assure the quality of training throughout the pilot study, improving training materials, and forming partnerships with universities, particularly those specializing in teacher education. These collaborations aim to enrich the diversity and quality of training offerings. Several universities have already expressed interest in participating in this initiative.

10 CONCLUSION

This study demonstrates the potential of integrating modern distributed learning methods into traditional distributed educational systems to enhance the quality and accessibility of education. Empirical studies examining case studies of teacher training within local municipalities have shown that digital badges, microlearning, and microcredentials can address the financial and motivational challenges faced by traditional distributed education systems. Employing these tools is expected to improve the quality of education, which in turn could enhance educational provision at the local level. Microcredentials constitute a promising method for verifying skills and knowledge acquired through distributed learning systems, thereby building trust among all stakeholders.

Furthermore, the experiment of this study provides evidence that this approach is not limited to teacher training but can also be applied to professional education in various industries requiring specialized skills, such as nursing, caregiving, civil engineering, and construction. Institutions of higher learning can also deliver professional education in these fields by leveraging online educational systems, microlearning, digital badges, and microcredential mechanisms through distributed learning. This approach proposes a system that expands on the professional education offered in industries requiring specialized skills, such as nursing, caregiving, civil engineering, and construction, providing access to lifelong learning opportunities.

The demonstration experiment described in this study is the first phase of a three-stage process; we anticipate that this pilot study will produce new insights as it progresses. The initial results are already promising, and further application and evaluation of distributed learning technologies and methods are expected to yield profound and actionable insights that will significantly inform educational reform. Subsequent stages will focus on a broader range of applications, the necessity of technical infrastructure, strategies for providing ongoing support and motivation for educators and learners, and solutions for integration challenges in diverse regional contexts.

The forthcoming phases are pivotal in seeking inventive educational solutions, undertaking empirical investigations, and fostering active partnerships among all educational stakeholders to unlock the full potential of distributed learning.

ACKNOWLEDGEMENTS

The use of teacher training data was approved by Osaka Kyoiku University. The authors would also like to thank Enago (www.enago.jp) for the English language review.

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