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An Architectural Planning Study on a Residential Regional Safety Experience Center Utilizing Idle Closed School Facilities in Mungyeong

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Abstract

Purpose: This study aims to propose architectural planning and remodeling guidelines for transforming underutilized closed school facilities into overnight regional safety experience centers in Mungyeong, Gyeongsangbuk-do. The proposed model is intended to respond to regional population decline while addressing the shortage of public safety education infrastructure in the northwestern region of Gyeongsangbuk-do through the adaptive reuse of abandoned educational facilities. **Research design, data and methodology:** A comprehensive research framework combining field investigation, case study analysis, demand survey, and architectural planning was adopted. Three representative underutilized closed schools in Mungyeong (Heeyang Branch School, Changgu Branch School, and Cheonghwa Branch School) were investigated to analyze their site conditions, building characteristics, and spatial configurations. In addition, domestic and international case studies on adaptive reuse of closed schools and safety experience facilities were comparatively analyzed. Based on the findings, architectural planning strategies, spatial programming, circulation systems, and operational models suitable for an overnight regional safety experience center were developed. **Results:** The findings indicate that standard classroom modules (65–75 m²) can be effectively reconfigured into large-scale safety simulation spaces through the integration of adjacent classrooms and appropriate structural reinforcement strategies. Outdoor playgrounds (approximately 10,000 m²) were identified as suitable locations for specialized disaster simulation facilities reflecting the mountainous characteristics of the Baekdudaegan region, including landslide and wildfire experience zones. Furthermore, integrating accommodation facilities within the upper floors of the existing school buildings enables the operation of overnight safety education programs while improving facility utilization through linkage with local tourism resources such as Mungyeongsaekjae Provincial Park. A standardized spatial allocation model consisting of Exhibition & Experience (50%), Education & Support (20%), Lodging & Community (20%), and Public & Disaster Response (10%) was also proposed. **Conclusions:** The proposed architectural planning model demonstrates the potential of closed school facilities to function as sustainable regional safety experience centers while simultaneously supporting local revitalization and disaster preparedness. The planning guidelines presented in this study may serve as a practical reference for local governments and educational authorities in establishing public safety infrastructure through the adaptive reuse of underutilized educational assets.

Keywords : Adaptive Reuse of Closed Schools, Regional Safety Experience Center, Architectural Planning, Space Planning, Disaster Shelter

JEL Classification Code : R11, R58, H54, I28, L74

1. Introduction

1.1. Research Background and Purpose

The decrease in the school-age population due to the prolonged ultra-low birth rate is going beyond the simple collapse of education infrastructure, accelerating the crisis of large number of idle school closures and local extinction. Mungyeong-si, located in the northern part of Gyeongsangbuk-do, is a typical population-endangered area with a population of about 66,000, and in particular, a number of elementary school branch schools are consolidated and left as long-term idle assets, especially in the Myeon-level area. The long-term neglect of such closed school assets is a hindrance to the influx of population by damaging the aesthetics of rural areas, deteriorating the site of youth derailment, and further causing hollowing-out of the entire community. At the same time, the public demand for practical safety education is increasing day by day in accordance with the complex disaster patterns of society as a whole. However, since the comprehensive safety experience center in Gyeongsangbuk-do is concentrated in the southern region (Gyeongju) and the northeastern region (Uiseong), students and residents in the northwestern region of Gyeongsangbuk-do, including Mungyeong, Sangju, and Yecheon, are experiencing geographical inequality that requires excessive travel time of more than two to three hours to complete compulsory safety education.

On the other hand, the Mungyeong area has strong hybrid site assets as the best experiential tourism hub in the central region, which attracts millions of tourists a year, including Mungyeong Saejae Provincial Park, Mungyeong Eco World, and railroad bicycles. Therefore, if Mungyeong's idle school is remodeled as a "stay-at-home complex safety experience facility" linked to local tourism resources rather than a general "single viewing type education center," it is possible to simultaneously achieve regional regeneration through the construction of a public safety net in the underdeveloped northwest region and the constant inflow of floating population.

Therefore, the purpose of this study is to analyze the current status and architectural characteristics of unused closed school assets in the Mungyeong area, and to propose a space plan and operation model for a stay-at-home safety experience center suitable for the northwestern part of Gyeongbuk based on domestic and international case analysis and demand surveys.

1.2. Scope and Limitations of the Research

The spatial scope of this study was set for three closed elementary schools (Gaeun Elementary School's Heeyang Branch School, Sannbuk Elementary School's Changgu Branch School, and Nongam Elementary School's Cheonghwa Branch School) located in Mungyeong, Gyeongsangbuk-do. The study was carried out according to the following procedure. First, the theoretical basis for the study was prepared by investigating laws, systems, literature, and policy data related to the use of closed schools. Second, domestic and foreign cases of closed schools and safety experience facilities were compared and analyzed in terms of architectural planning, space composition, and operation characteristics. Third, the possibility of remodeling was reviewed by investigating the current status and structural characteristics of closed schools in Mungyeong. Fourth, space demand was analyzed by investigating the preference for the safety experience program targeting stakeholders such as teachers and residents. Fifth, based on the case analysis and demand survey results, indoor and outdoor space plans, movement plans, and structural reinforcement measures were proposed. Finally, the possibility of utilizing the proposed model was reviewed by performing a simulation comparing the annual operation rate of the existing operation method and the stay complex operation method.

2. Theoretical Background

This chapter intends to review laws, systems, and policies related to the use of idle closed schools, and to draw architectural planning implications by comparing and analyzing cases of regeneration of closed schools at home and abroad. In addition, it is intended to present a theoretical basis for setting the direction of spatial planning and remodeling for the creation of local safety experience centers, and to prepare basic data for future design plans.

2.1. Strategies for Utilizing Closed School Property and Limitations of the Legal System

The attribution and disposal of closed school assets in Korea are basically controlled in accordance with the 'Special Act for Promotion of Use of Closed School Property'. As specified in Articles 1 and 5 of the same Act, closed school property is approved for sale or loan

only within the purpose of educational facilities, cultural facilities, public sports facilities, social welfare facilities, and facilities to increase residents' income.

Until now, the use of closed schools in rural areas, including the Mungyeong area, has often been loaned for a single purpose, such as individual artists' ateliers, simple camping sites, or low-temperature warehouses of local farming associations such as Omija and Apple. However, this method has resulted in side effects that cause conflicts among residents as facilities are closed or privatized again due to low profitability compared to the initial cost of remodeling facilities, a sharp drop in winter utilization rate, and lack of expertise by the operating entity. Therefore, in order to ensure permanence without damaging the value of closed schools as public goods, a strategy of "becoming a base for community-win safety infrastructure" that integrates education, disaster prevention, and local community job supply is required.

2.2. Concept and space components of the safety experience center

The safety experience center is a public infrastructure that helps subjects to embody their practical response by accurately reproducing everyday crisis situations such as fire, traffic, and natural disasters with architectural and mechanical devices. In order to densely accommodate variable simulators corresponding to the Ministry of Public Administration and Security's "Seven Standards for Safety Education," the movement of the facility should strictly exclude linear viewing movements and operate the movement itself as a street simulation. The live load and special height requirements of large equipment are the top mechanical variables to gauge the structural suitability of existing old school buildings.

3. Analysis of Domestic and Foreign Similar Cases

3.1. Overview of case analysis and selection of targets

In this study, three domestic best cases in operation by remodeling the closed school into a public safety and

value complex and one overseas best case in which idle sites were converted into local disaster prevention anchors were selected and scrutinized.

3.2. Space configuration and operational characteristics per case

3.2.1. Gyeongju Safety Experience Center (standard variableization of small teacher modules in farming and fishing villages)

This is a facility that was remodeled and opened at the site of the closure of the old Angang Bukbu Elementary School. The internal space was variably redacted while maintaining the 'universal map and classroom modules (about 65 to 75 m²), which are the flat structure of a typical small elementary school in rural areas, in its original form. Using the classroom module specifications, the experience rooms based on seven standard plans were densely arranged, and the corridors were made three-dimensional as movement-type experience spaces such as smoke evacuation training. Budget-saving planning standards using existing partition walls without large-scale construction are presented. (Refer to [Figure 1] for a detailed view of the facilities, which will be described later.)

3.2.2. Student Safety Experience Education Center (strengthening the structure and three-dimensional connection of indoor and outdoor spaces)

It is a large-scale base-type safety education facility using the closed site of the former Munsan Middle School. The large site and high-rise conditions of the middle school teacher's building were actively utilized, and some extensions were made in parallel to accommodate large-scale equipment. As a result of the field survey, some spaces were planned and operated as spaces that integrated existing classrooms for the installation of large-scale experience facilities, and various experience facilities such as ship and aviation disaster simulators were established. In addition, the playground site was established and operated as an outdoor high-end escape tower and a traffic safety practice site, and the specific space composition and facility arrangement status are presented in Figure 2.

3.2.3. Gyodong Peace School in Incheon (complex stay to overcome geographical outskirts)

Gyodong, Ganghwa County, Incheon, is also the first case of remodeling the old Nanjeong Elementary School's closure into a restart education complex. In order to overcome the geographical accessibility limitations of island areas, living activities (accommodation facilities and restaurants) that can stay for one night and two days were arranged vertically and horizontally, and community cafes run by residents were opened to promote population inflow. This shows that the essential installation of accommodation features is the key to revitalization here in the case of regeneration of closed schools on the outskirts where access is weak.

3.2.4. Tachikawa Disaster Prevention Center, Japan (local disaster prevention base and complexation of idle infrastructure)

It is a comprehensive safety experience facility in Tokyo, Japan, built during the redevelopment of idle sites at military airfields in the past. It usually functions as a disaster prevention education center for ordinary citizens and students, but in the event of an actual disaster, it has a hybrid structure that is immediately converted to a local evacuation center. In addition to natural disaster simulations, large-scale relief goods stockpiles are placed in underground and background spaces, and the outer square is planned as an open space that can provide emergency vehicle and aviation assistance in the event of a disaster, functioning as a regional disaster prevention base.

As a result of a comprehensive analysis of the above cases, safety experience facilities using closed schools include efficient use of existing classroom modules, securing large spaces through structure reinforcement, organic connection of indoor and outdoor experience spaces, complex stay functions, and securing regional disaster prevention bases. Therefore, this study proposed a space plan for a stay-type safety experience center that reflects the regional characteristics and tourism resources of the Mungyeong area based on the results of this case analysis.

3.3. Visual and Case Analysis Comprehensive Matrix

Figures 1 and 2 illustrate the representative domestic safety experience facilities analyzed in this study and summarize the major architectural characteristics

identified through the case analysis.



Figure 1: Gyeongju Safety Experience Center Facility

Note: Remodeling of Closed Classrooms in Elementary School and Current Status of Outdoor Traffic Safety Practice Center



Figure 2: Space Composition of Student Safety Experience Education Center

Note: Integrated multiple partition walls and indoor ship evacuation simulation facilities

Table 1: Domestic and Domestic idle facility remodeling and disaster prevention convergence case analysis matrix

Case Analyzed	Key Architectural	Characteristics of Major Spatial	Key Points Reflected in the
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	Remodeling Elements	Programs	Planning Proposal
Gyeongju Safety Experience Center	Flexible adaptation of standard classroom modules (65–75 m ²)	Compact experiential rooms based on seven standard program models	Arrangement of small-scale booths utilizing the existing classroom dimensions
Student Safety Experience Education Institute	Integration of multiple classrooms and three-dimensional utilization of the schoolyard	Large-scale simulators and an emergency escape-descender training tower	Structural reinforcement and separation of indoor and outdoor circulation routes
Incheon Gyodong Peace School	Integration of educational, accommodation, and community functions	Two-day, one-night residential program and community café	Introduction of infrastructure for residential safety camps
Tachikawa Disaster Prevention Center	Hybridization of educational spaces and emergency evacuation functions	High-intensity disaster experience programs linked with an emergency relief supply storage facility	Strengthening its role as a regional disaster-prevention and evacuation shelter

4. Analysis of the current status and structure and requirements of the destination

4.1. A Quantitative Analysis of the trend and destination of idle closed schools in Mungyeong area

In order to secure the empirical validity of this study, the accumulated amount of idle closed school assets in Mungyeong and the recognition index of the safety experience of residents in the northwestern part of Gyeongsangbuk-do were cross-analyzed.

Table 2: Current Status of Major Closed Schools in Mungyeong Area

No	School Name	Date of Closure
1	Seonam Branch, Nongam Elementary School	Mar. 1, 2000
2	Munyang Branch, Gaeun Elementary School	Mar. 1, 2002
3	Bongmyeong Branch, Dongseong Elementary School	Mar. 1, 2002
4	Hogye Branch, Mungyeong Middle School	Mar. 1, 2003
5	Sanbuk Information High School	Mar. 1, 2005

6	Yeongchang Branch, Yeongsun Elementary School	2008
7	Daeseong Branch, Singi Elementary School	2009
8	Geumdong Branch, Sanyang Elementary School	2009
9	Maseong Branch, Dongseong Elementary School	2010
10	Huiyang Branch, Gaeun Elementary School	Mar. 1, 2025
11	Changgu Branch, Sanbuk Elementary School	Mar. 1, 2025
12	Cheonghwa Branch, Nongam Elementary School	Mar. 1, 2025

In Mungyeong City, a number of elementary schools and branch schools have been closed since 2000 due to the continuous decrease in the school-age population and the decrease in the number of students in rural areas. In particular, in 2025, three additional branch schools, including Gaeun Elementary School's Heeyang Branch, Sannbuk Elementary School's Changgu Branch, and Nongam Elementary School's Cheonghwa Branch, increased the number of idle educational facilities. These closed schools are evaluated as potential space resources that can be recycled into public safety experience facilities, disaster response base facilities, and local complex facilities at the same time as a cause of local hollowing out.

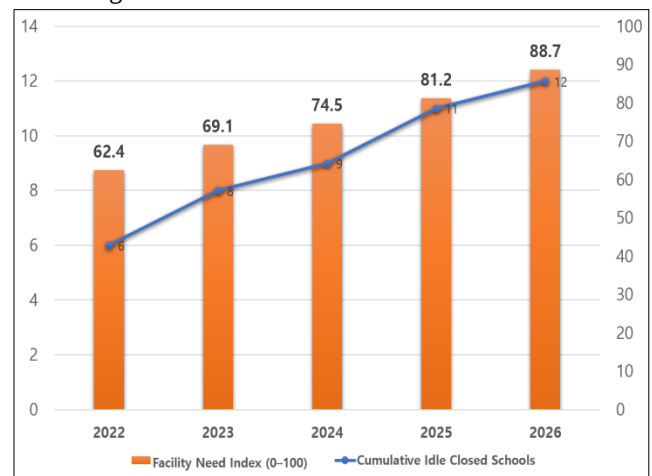


Figure 3: Trends in the Cumulative Number of Idle Closed Schools and the Facility Need Index in Mungyeong (2022–2026)

Figure 3 shows that the cumulative number of idle closed schools in Mungyeong increased steadily from 6 in 2022 to 12 in 2026. During the same period, the Facility Need Index also rose from 62.4 to 88.7, indicating a growing demand for the establishment of a regional safety

experience center. These results suggest that the increasing number of idle closed schools is accompanied by a heightened recognition of the need to utilize such facilities for public safety purposes.

In addition, as a result of data analysis, it was found that the number of unused and planned loans in Mungyeong increased from 6 in 2022 to 12 as of 2026, continuing the problem of long-term idling. In addition, the index for the establishment of a safety experience center in the northwestern part of Gyeongsangbuk-do (Mungyeong, Sangju, Yecheon) was high at 88.7 points, which was analyzed to support the need to use closed school assets

as local safety infrastructure. Therefore, this study selected the following three closed schools as key remodeling targets based on the current status of the Mungyeong Office of Education. The quantitative specifications and structural constraints of each target site are shown in Table 3.

Table 3: Quantitative Specification and Building Plan Reinforcement Guidelines for Major Unutilized Closed School Assets in Mungyeong Area to Study

Target Closed School (Branch)	Site Area (m ²)	Gross Floor Area (m ²)	Floors / Building Age	Remodeling Usable Area (%)	Structural Engineering and Architectural Planning Directives
Gaeun Elementary School, Huiyang Branch (Gaeun-eup, Mungyeong)	12,014	920.5	2 Floors / 38 Years (Completed in 1988)	91.2% (Moderate deterioration)	• Structural review confirmed no major defects; allowable bearing capacity satisfied (3.0 kN/m²). • Roof waterproofing and exterior wall painting required due to aging. • Existing classroom layout suitable for conversion into safety experience classrooms.
Nongam Elementary School, Cheonghwa Branch (Nongam-myeon, Mungyeong)	10,245	1,120.8	2 Floors / 32 Years (Completed in 1994)	94.5% (Good condition)	• Structural review confirmed no significant damage; seismic performance meets current standards. • Interior spaces can be remodeled into accommodation facilities (including barrier-free rooms) and educational facilities with minimal structural modification. • Roof, windows, and HVAC systems require partial replacement.
Sanbuk Elementary School, Changgu Branch (Sanbuk-myeon, Mungyeong)	9,599	781.2	1 Floor / 44 Years (Completed in 1982)	82.3% (High deterioration)	• Structural safety evaluation recommends partial reinforcement due to aging. • Floor slab strengthening and roof waterproofing are required. • Interior partition walls should be removed to create large-span experience spaces, and carbon-fiber reinforcement is recommended for structural strengthening.
Total	31,858	2,822.5	Average 38 Years	Average 89.3%	All three facilities satisfy the minimum requirements for conversion into a regional safety experience center, with adequate site area (≥50%), building coverage ratio (≤20%), and spatial adaptability.

The total land area of the three unused closed schools in Mungyeong area analyzed in this study was 31,858 m², and the total floor area of the teacher's building was counted as 2,822.50 m² (see Table 3). In particular, in the case of a window branch school in Sanbuk Elementary School, which has 44 years of dry age and is severely structural vulnerable, it is necessary to avoid the simple removal of the inner wall during plane remodeling and to

apply the steel H-beam grid-type composite frame structure reinforcement method proposed in Chapter 5 of this study. On the other hand, the Heoyang branch school in Gaeun Elementary School, which has the most available site area of 12,014 m², is classified as a key target site for plane planning to apply an outdoor training site specializing in mountainous terrain.

4.2. Hardware and Structural Characteristics of Mungyeong Closed School

Most elementary school closures in Mungyeong have a two-story reinforced concrete ramen structure and maintain a standard design partition wall system of 6.0 m × 9.0 m modules. When repurposing a safety experience center, it

is essential to bring in high-weight facilities such as landslide and soil collapse model equipment due to the topographical characteristics of Mungyeong. However, since the floor active load (3.0 kN/m²) of the existing classroom falls short of the experience center standard (5.0 kN/m²), it is believed that a grid-shaped column-beam reinforcement structure using steel H-beam can be applied as an alternative to securing structural safety of the lower slab. This reflects the results of comparing the design active load of existing school facilities with the required load of experience facilities, and it is necessary to apply the relevant structural design standards (KDS) and the reinforcement standards suggested in existing structural safety studies to secure structural safety. Therefore, in this study, a steel H-beam composite frame reinforcement plan was proposed in consideration of structural safety and constructability.

4.3. Mungyeong Specialized Program Preference Survey

In order to understand the specific demand for the space program, a survey was conducted on teachers, residents, and parents in Mungyeong area. The survey was conducted in a self-written questionnaire method from April to June 2026, and a total of 400 questionnaires were distributed to collect 350 copies, and the collected questionnaires were used for analysis. The questionnaire was organized around the necessity of the safety experience program, the appropriateness of the space composition, and the preference for specialized programs in Mungyeong area, and all questions were analyzed by applying a 5-point Likert scale. The recovery rate was 87.5%, securing the representativeness and availability of

the survey data.

Table 4: Results of a survey on preference for Mungyeong-specific safety programs by consumer purpose

Standard Category (Based on Seven National Safety Experience Areas)	Mungyeong-Specific Program Contents	Teachers' Preference Score (5.0)
Natural Disaster Safety(Specialized)	Baekdudaegan Mountain Forest Evacuation Experience	4.82
Social Disaster Safety	Underground Tunnel Fire Evacuation Training	4.31
Life Safety(Specialized)	Giant Indoor Descender (Escape Device) Experience Tower	4.65
Health and Daily Safety	Cardiopulmonary Resuscitation (CPR) and Infant Emergency Care	4.35
Transportation Safety	Agricultural Machinery and Personal Mobility (PM) Operation Training	3.52

As a result of the survey, the preference for disaster experience programs reflecting the regional characteristics of Mungyeong, a mountainous terrain, was high, and based on these results, Chapter 5 planned the outdoor playground site as a mountain disaster-specific experience space and reflected it in the space composition.

5. Proposed Plan for the Safety Experience Center for the Use of Closed Schools

5.1. Default orientation and process transition matrix for plan

In this study, the spatial composition of the existing school architecture was reinterpreted, and a step-by-step spatial planning process was proposed that reflected the disaster prevention characteristics of the Mungyeong area and the concept of stay-type operation. The detailed procedure is shown in Table 5. This plan was based on the basic direction to efficiently organize the sum of the standard total floor area (2,822.50m²) of unused closed schools in Mungyeong as a space for each function.

Table 5: Phase-by-Stage Plan Transition Process Matrix of the Mungyeong Area Standard Closed School Module

Phase	Existing Building Conditions (Input)	Architectural Planning and Remodeling Process (Process)	Functional Transformation (Output)
Phase 1 (Small-Scale Remodeling)	- Standard elementary school classroom modules retained - Column spacing: approximately 6.5–7.5 m - Independent two-story reinforced concrete structure	- Installation of movable lightweight partition walls - Replacement and reinforcement of interior finishes - Improvement of minimum evacuation circulation (≥ 1.2 m)	[Introductory Safety Experience Zone] - CPR and emergency response training - Basic disaster and emergency education
Phase 2 (Space Integration)	- Removal of selected interior walls - Existing structure designed to support live load of 3.0 kN/m² - Floor height approximately 2.8–3.2 m	- Elimination of unnecessary partitions to secure larger spaces - Reinforcement of steel frames where required - Floor load strengthening to 5.0 kN/m²	[Mungyeong Specialized Experience Zone] - Baekdudaegan mountain disaster simulation - Underground tunnel fire and social disaster response training
Phase 3 (Linear Circulation Planning)	- Existing corridor width approximately 2.4–3.0 m - Suitable for evacuation circulation despite aging	- Reconfiguration into a one-way circulation system - Installation of safety signage and LED guidance system - Integration of barrier-free (BF) design principles	[Indoor Evacuation Experience Street] - Indoor disaster response and evacuation simulation street
Phase 4 (Expansion of Outdoor Facilities)	- Existing playground area approximately 10,000 m² - Sufficient space for vehicle access and outdoor activities	- Installation of a three-story outdoor escape tower - Reinforcement of structural foundations - One-way pedestrian circulation plan	[Outdoor Disaster Experience Zone] - Baekdudaegan forest evacuation experience - Giant indoor/outdoor escape tower training
Phase 5 (Accommodation and Shelter Integration)	- Existing administrative building adjacent to the main facility - Simple accommodation layout suitable for conversion - Direct connection with surrounding community	- Renovation of the second floor into accommodation for approximately 40–60 users - Expansion of parking capacity to approximately 50 vehicles - Installation of distributed seismic isolation bases	[Disaster Prevention Base and Shelter] - First-floor emergency command and education facilities - Second-floor regional disaster shelter

5.2. Detailed floor plan and flow plan by space

5.2.1. Interior Experience Space and Structural Reinforcement Plan (Teacher Building Remodeling)

Considering the characteristics and scale of the experience program, the existing teacher building was planned to be divided into a small experience space and a large space experience space. One existing classroom room (about 65 to 75 m²) is divided into a CPR and

outdoor first aid training center and a variable lightweight sound insulation wall with a thickness of ≥ 50 mm is applied. On the other hand, in the area where high-weight Baekdu-dae landslide soil simulator and tunnel fire escape equipment are installed, after completely removing the strength walls of the adjacent two to three classrooms, the target live load needs to be designed to satisfy the relevant structural criteria ($U = 0.9D + 1.6W$) and KDS 21 60000 design criteria.

Considering the existing structural safety standards (KDS) and structural safety, a plan was proposed to apply a steel H-type composite frame as an alternative to securing a large space. The cross-sectional specification of H-type steel needs to be determined according to the results of future structural calculation. Reinforcement of carbon fiber sheet (CFRP) can be considered as a reinforcement alternative to improve the structural performance of the floor, and the target live load needs to be designed to meet the relevant structural criteria. On the side of the 2.4-3.0 m wide corridor, a dark maze partition wall is zigzagged, and a wildfire smoke generating nozzle is buried on the ceiling and an LED emergency guide light is buried on the floor to make the corridor itself a "Simulation Street."

5.2.2 Outdoor experience and connection space (plan to utilize the playground site): A three-story tall, three-story, high-rise and horizontal valley structure tower (around (10m)) that reproduces the mountain isolation situation between Baekdudaegan by utilizing large playground sites (about 12,014 m²) such as Heeyang Branch School in Gaeun Elementary School will be placed. The outer circular one-way parking path is projected on a plane to block the bottleneck of weekend family tourist cars and weekday group buses (applying the minimum radius of rotation (12m)).

5.2.3 Stay and disaster prevention complex base plan (living dong and shelter): In order to absorb tourism demand in Mungyeong Saejae, the upper floor of the second floor of the Cheonghwa branch school building in Nongam Elementary School will be completely converted into an ondol-type and double-decker bed-type accommodation space (living dong) for four to six people, and night control shutters and independent evacuation stairs will be provided. In order to control distributed support due to additional accommodation loads, the possibility of applying auxiliary support structures such as jack bases as a structure reinforcement measure for additional load distribution near the foundation was proposed. On the right side of the lobby on the first floor, Mungyeong Omija/Apple Cafe and local canteen will be placed to create jobs for residents. On the left and right sides of the auditorium floor, a stockpile warehouse of (50m^2) or more, which houses relief tents and disaster prevention supplies, will be placed adjacent to the floor area, and emergency power circuits will be built to function as the "first designated disaster prevention shelter" in the northwestern part of Mungyeong in the event of an actual disaster.

Such a structural reinforcement plan is a remodeling plan

that considers both securing large space and structural safety while maintaining the structure of existing school buildings as much as possible.

5.3. Proposed criteria for area allocation by use of safety experience center

In this study, standard area allocation standards and building planning guidelines for each use were proposed in consideration of the space efficiency and operability of local safety experience centers using idle closed schools in Mungyeong. In particular, by presenting the appropriate ratio of education and support spaces, stay and complex spaces, and public and disaster prevention spaces centering on exhibition and experience spaces, the experience function, education function, and disaster response function were planned to be organically linked. In addition, by presenting the principle of space planning that can reinforce the structure, secure evacuation routes, and convert shelter in case of a disaster, it was intended to provide basic data that can be used for remodeling and design of similar facilities in the future.

Table 6: Standard Area Allocation and Building Guidelines for Mungyeong Remodeling Safety Experience Center

Space Category	Space Allocation Ratio (%)	Key Architectural Planning Guidelines
Exhibition and Experience Areas	$\geq 50\%$	Structural reinforcement with H-beams is required in areas where load-bearing walls are removed. Corridors should be redesigned as Evacuation Streets to improve emergency evacuation efficiency.
Education and Support Areas	15–20%	The entrance lobby should be directly connected to the orientation hall to improve visitor circulation and reduce congestion.
Accommodation and Multi-purpose Areas	15–20%	Accommodation spaces should be vertically separated from educational areas by locating them on upper floors or in an independent building.
Public and Disaster Response Areas	10–15%	A distributed evacuation circulation system should be provided to enable immediate conversion into an emergency Shelter during disasters.

6. Sustainable Governance and Economic Analysis

6.1. Gyeongbuk Office of Education - Mungyeong City Cooperation Governance

In this study, a plan to establish cooperative governance

with Mungyeong City was proposed by utilizing the Gyeongbuk Office of Education's Free Loan Project for Unutilized Closed School Property as an institutional foundation. The Mungyeong Office of Education rents closed school property for free for up to 20 years, the Mungyeong City raises the budget through the Ministry of Public Administration and Security's Special Grant Tax and Local Extinction Response Fund, and the Mungyeong Fire Station cooperates with related agencies such as Mungyeong Fire Station to establish an operating system linked to the plan for the three-way cooperative governance administration process, which operates specialized safety education programs.

6.2. Comparative Simulation of the Mungyeong Tourism-linked Utilization Rate

This study conducted a simulation to examine the operational efficiency of the proposed stay-type safety experience center. The simulation compared and analyzed the annual operation rate of the existing viewing-type operation model and the stay-type complex operation model by setting the current status of the influx of tourists in Mungyeong area, the use of school groups, the operation of family experience programs, seasonal use characteristics, and the operation plan during the vacation period as major variables.

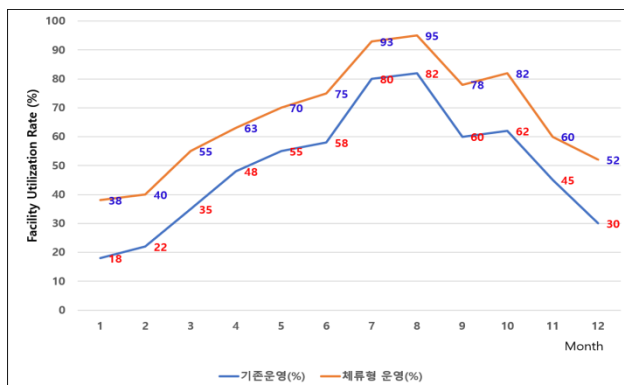


Figure 4: Simulated Monthly Utilization Rates of the Mungyeong Safety Experience Center by Operational Model

Figure 4 compares the projected annual utilization rates between the conventional day-visit operation model and the proposed residential safety experience center. The simulation indicates that the residential operation model maintains consistently higher utilization throughout the year by combining school education programs, family-oriented weekend activities, tourism-linked overnight

programs, and seasonal operation strategies. As a result, annual facility utilization is expected to improve substantially, thereby reducing the risk of off-season underutilization and enhancing long-term operational sustainability

Table 7: Simulated Monthly and Annual Facility Utilization Rates by Operational Model

Month	Conventional Day-Visit Model Utilization Rate (%)	Proposed Residential Model Utilization Rate (%)
January (Off-season)	12.5	42.1 (Winter Safety Camp Operation)
April (Peak School Excursion Season)	68.4	72.5
July (Summer Vacation)	15.1	58.4 (Summer Safety Camp Operation)
October (Peak Season)	74.2 (School Excursion Season)	82.6 (Linked with the Mungyeong Festival)
Average Annual Utilization	41.2	63.4

This simulation represents a predictive scenario-based model developed from tourism statistics and field survey results in Mungyeong City rather than actual operational data. Therefore, the projected utilization rates should be regarded as preliminary reference data for evaluating the operational feasibility of the proposed facility. Future studies should validate these findings using actual operational performance after the facility is established. The simulation results indicate that the conventional day-visit model experiences substantial declines in facility utilization during off-peak periods, with utilization rates of 12.5% in January and 15.1% in July. In contrast, the proposed residential model maintains higher utilization rates of 42.1% and 58.4%, respectively, by integrating weekend family safety camps and tourism-linked residential programs associated with Mungyeong Saejae. Overall, the average annual facility utilization is projected to increase from 41.2% to 63.4%, representing an improvement of 22.2 percentage points. These findings suggest that the proposed operational model could reduce seasonal fluctuations in facility use, improve operational efficiency, and contribute to the long-term financial sustainability of the regional safety experience center.

7. Conclusions and Future Research

7.1. Summary and Conclusions

This study proposed architectural planning and remodeling guidelines for converting idle closed school facilities in Mungyeong into a residential regional safety experience center serving the northwestern region of Gyeongsangbuk-do. Based on field investigations, case analyses, architectural planning, and operational simulations, the major findings are summarized as follows.

First, this study proposed a flexible structural reinforcement strategy for the adaptive reuse of conventional elementary school classroom modules. The applicability of a grid-type H-beam reinforcement system was verified for the integration of multiple classrooms, while planning guidelines were established for transforming existing corridors into evacuation simulation streets. The proposed reinforcement method is considered a practical remodeling solution that preserves the existing structural system while simultaneously improving spatial flexibility and structural safety.

Second, a tourism-linked residential operation model was proposed to overcome the locational limitations of rural closed schools. Accommodation facilities on the upper floors and community-oriented café spaces were incorporated into the architectural plan, enabling stronger connections between safety education, local tourism resources, and community participation. The operational simulation indicates that this integrated model can improve annual facility utilization and enhance the long-term sustainability of facility management.

Third, this study introduced a hybrid disaster shelter concept that integrates public safety education with disaster response functions. During normal operation, the facility serves as a regional safety experience center implementing the seven national safety education programs. In the event of a disaster, the same facility can be rapidly converted into a primary disaster shelter providing temporary evacuation space and emergency relief services for local residents. This dual-function planning concept expands the public value of idle closed school facilities beyond their conventional educational role.

Overall, this study is meaningful in that it presents practical architectural planning and remodeling guidelines for transforming idle closed schools into regional safety experience centers. The proposed planning framework provides a practical reference model that can be applied to other rural regions experiencing population decline, educational facility closures, and

shortages of public safety infrastructure.

7.2. Limitations and Future Research

Despite these contributions, this study has several limitations. First, the proposed planning framework is limited to architectural planning and conceptual remodeling guidelines. For practical implementation, future research should examine the applicability of building regulations and fire safety codes associated with changes in building occupancy from educational facilities to mixed-use accommodation and exhibition facilities, including sprinkler requirements, evacuation stair design, and emergency egress standards.

Second, the proposed structural reinforcement strategies were developed at the planning level without detailed structural engineering analyses. Future studies should establish engineering-based reinforcement guidelines according to the structural condition of individual closed school buildings and evaluate their structural safety and economic feasibility.

Finally, the operational model and facility utilization rates presented in this study were derived from simulation scenarios based on regional tourism statistics and field survey results rather than actual operational data. Therefore, future research should verify the proposed model through pilot remodeling projects and long-term operational evaluations, while incorporating life-cycle cost analysis, user satisfaction assessments, and post-occupancy evaluations to further improve the practical applicability of the proposed architectural planning model.

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