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A Case Study on Implications for Classroom Organization and Teaching-Learning Methods: Focusing on High School Credit Systems and Green Smart Initiatives

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Abstract: This study situates itself at the convergence of two transformative educational developments in South Korea: The Green Smart School Initiative, which aims to remodel old schools into modern, eco-friendly learning environments, and the High School Credit System, introducing an unprecedented level of flexibility and choice. Despite the valuable opportunity these initiatives present to reform high school education, they also pose substantial challenges. This research navigates these challenges by investigating the preferred teaching-learning methods across different grade levels, assessing the spatial necessities for each subject, and understanding the need for specialized classrooms. To explore the role of school context in the transformation of school space, the study focused on a high school in Seoul as a case study. Results of the study revealed a complex array of preferences and requirements that were grade-dependent. These variations necessitated a nuanced approach to learning spaces, leading to the proposal of a partial subject class system. Subject-specific needs highlighted a range of spatial and facility requirements, and in response, specialized classrooms named 'expression rooms', 'workrooms', and 'physical activity rooms' were proposed. These specialized classrooms, more than just functional spaces, embody an educational philosophy valuing interdisciplinary learning and innovation. The implications of this study extend beyond the classroom, proposing a structural overhaul of the school to reflect the differing needs of students at different educational stages. In conclusion, this study provides a framework for re-envisioning high school education in the context of the Green Smart project and the High School Credit System. It suggests that by aligning the physical surroundings with the educational objectives, schools can be constructed that not only prepare students for examinations but also for lifelong learning.

Keywords: Green Smart School initiative, High School Credit System, Specialized Classrooms, Teaching-Learning Methods, Spatial Requirements in Education

1. Introduction

In the face of the rapidly evolving educational landscape, an imperative for innovative transformations in the design of curriculum structures and the execution of educational practices has emerged. One prominent embodiment of such transformation is the integration of the High School Credit System (HSCS). This radical reform presents a significant shift from the conventional, homogeneous approach towards curricula, paving the way for a more customized learning environment[1]. Within this

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modified educational framework, students are accorded a greater degree of autonomy, thus empowering them to actively navigate their individual academic journeys.

As Korea prepares for a comprehensive implementation of the HSCS by the year 2025, many challenges have surfaced that necessitate immediate attention and resolution at the school level. While a substantial body of research has concentrated on the institutional nuances of deploying a diversified array of subjects as part of the HSCS, pragmatic solutions to the immediate problems encountered within schools remain noticeably lacking. Schools find themselves at a critical crossroads, grappling with decisions concerning the organization of subjects. Choices range from opting for a course structure that dismisses grade divisions, thus advocating for complete student mobility, to providing an extensive range of elective courses contingent on grade divisions.

Simultaneously, in tandem with these educational transformations, green smart national projects aimed at revitalizing underprivileged schools have been gaining momentum in Korea. The Green Smart Project extends beyond the rudimentary objective of revamping archaic school buildings. Rather, it is a mission to develop educational facilities that resonate with the broader educational aims and aspirations [2]. In essence, these initiatives underscore the importance of reconceptualizing academic spaces in alignment with pedagogical objectives, thus weaving a tangible connection between the physical environment and the intangible learning experiences.

Furthermore, these green smart endeavors harmonize with the global impetus to advocate for environmental stewardship. By providing a platform to incorporate sustainable practices into the very fabric of school infrastructure, the Green Smart Project echoes the worldwide call for sustainable development.

Within the tapestry of these transformations, high schools hold a unique position. The changes induced introducing of the HSCS need to be seamlessly dovetailed with alterations in the physical learning environment. To achieve this synchronicity, it becomes necessary to investigate into the study of the potential shifts these institutions will undergo in adaptation to the HSCS, particularly concentrating on the aspect related to the spatial configuration of learning environments.

The aim of this study is to investigate the complexities that lie at the confluence of these evolutionary threads within the context of high school education. The study is steered by two primary research questions:

1. What are the impending challenges associated with the initiation of classes in high schools, especially in preparation for the HSCS?
2. What strategies might be utilized to transform school spaces in a manner conducive to the successful implementation of the HSCS under the umbrella of the Green Smart Project, and what potential pedagogical prospects might such reconfigured spaces engender?

By exploring these questions, this study aspires to shed light on valuable insights that can potentially inform and shape policy formulation, curriculum innovation, and architectural planning in the era of HSCS and Green Smart School. The findings from this research aim to lay a foundation for future-oriented, sustainable, and student-centered educational practices.

2. Theoretical Background

High School Credit System (HSCS) and Green Smart School initiatives are distinct yet harmoniously synchronizing forces currently shaping the educational arena in South Korea. These innovations signal a profound shift from minor modifications to extensive reconfigurations of the curriculum structure and the physical layout of educational institutions respectively. For a comprehensive understanding of these transitions, it becomes essential to investigate into the theoretical principles underpinning these initiatives[2].

The HSCS is emblematic of a shift towards a student-centered approach that prioritizes the cultivation

of core competencies[3]. Core competencies, including creativity, critical thinking, and problem-solving skills, are fundamental for navigating and addressing the complex challenges of the 21st century[4]. This pedagogical perspective, embodied by the HSCS, provides students the autonomy to tailor their academic pathways to their individual aspirations and interests. Consequently, this approach engenders a more engaged and self-directed learning experience[5].

This paradigm shift in South Korea's curriculum represents a significant departure from conventional, rigid curricular frameworks. It signals a reorientation of the educational system, placing an enhanced focus on a competence-based education system tailored to individual students' abilities and aspirations. Thus, the HSCS promotes a dynamic and flexible curriculum that caters to the diverse learning styles and interests of students, marking a transformation in the traditional educational system

In parallel, the concept of Green Smart Schools marks an innovative shift in the domain of educational infrastructure. Grounded in sustainable education and smart learning environment theories, these schools aim to imbibe sustainability principles in school infrastructure and pedagogy, fostering environmentally conscious behaviors among students[6]. Smart learning environments utilize digital technologies and data analytics to augment the teaching and learning processes, providing a platform for dynamic, interactive, and personalized education[7].

In the South Korean context, Green Smart School initiatives stand as a concerted endeavor to metamorphose schools into sustainable, technologically advanced, and student-friendly spaces. These initiatives align with South Korea's commitment to digital innovation and environmental sustainability, evident in national policies such as the Green Growth Policy and the Smart Education Strategy. As such, Green Smart Schools project a transformative vision of educational infrastructure that is not only sustainable but also conducive to the learner-centric educational paradigm represented by the HSCS.

While juxtaposing curriculum revision (as embodied by the HSCS) and architectural transformation (as envisioned by Green Smart Schools) within the same narrative might appear challenging, these concepts are not isolated phenomena. They represent two critical aspects of a broader educational metamorphosis aimed at fostering a more student-centric, sustainable, and technologically sophisticated learning environment. The interplay between curriculum and infrastructure encapsulates a comprehensive vision for the future of education in South Korea, which cultivates core competencies in students while nurturing their understanding of sustainability principles.

Unpacking these transformative shifts entails delving into the theoretical frameworks of competence-based education and Green Smart Schools. These conceptual foundations guide the exploration of the complexities of these evolving educational landscapes, shedding light on the opportunities and challenges that South Korea's high schools face as they embark on this transformative journey. This exploration, underpinned by rigorous academic scrutiny, seeks to enrich our understanding of these developments and inform future policy decisions, curriculum designs, and architectural considerations in the era of HSCS and Green Smart Schools[8].

3. Research Method

3.1 Context of the Case

In the context of the research method, the particular case of Daemoon High School(pseudonym) stands as a salient example, one that was deeply influenced by both its physical environment and the institutional mandate for progressive change. Faced with the constraints of an older infrastructure, the school struggled with operationalizing the HSCS in its full potential. This system, intended to diversify and expand elective course offerings and promote a student-centric approach, often bumped up against the reality of the school's aged building. The challenges presented were twofold - the curriculum needed to adapt to the new pedagogical paradigm, and the physical spaces of the school needed to be re-

envisioned to support this pedagogical shift.

The pursuit of an improved curriculum, accompanied by a reformed school environment, represented an ardent endeavor on the part of the school. This aspiration was the driving force behind the adoption of a comprehensive case study method in this research. The case study was meticulously designed to capture the multi-faceted and complex nature of the transition towards a HSCS within a Green Smart School context.

Spanning over a period of approximately six months, the research process took into account various aspects of this transformation. This included gauging the viewpoints of different stakeholders, collecting data through visits and interactions, making informed decisions, and finally, implementing these decisions within the confines of the old school building. Through each of these steps, the school's strong desire to improve the curriculum and refurbish the school environment was always at the forefront.

In the process of investigating this case, a balanced and respectful stance was maintained, considering the opinions and experiences of the school members. This was achieved while providing information that could aid in their decision-making process, thereby upholding the integrity of the research.

[Fig.1] Photos of Daemoon School

3.2 Research Procedures

The research approach at Daemoon High School was undertaken over a six-month period, a duration chosen to ensure comprehensive data collection while facilitating a thorough investigation of the challenges and potential solutions arising from the intersection of the HSCS and the Green Smart School initiative. This in-depth case study spanned several distinct phases:

Initial Meeting and Discussion (June 14th): The research process started with an introductory meeting between the School Transformation Facilitation (TF) team, an architect, and the researcher. This first visit was to discuss potential curricular improvements, share the direction of the school reconstruction, and understand the school’s vision for the HSCS and Green Smart initiative.

Faculty-wide Dialogue (July 5th): The next phase involved a meeting with all faculty members and the architect, which focused on discussions about future societal and educational changes. It was also an opportunity to understand pedagogical approaches and strategies in light of the HSCS.

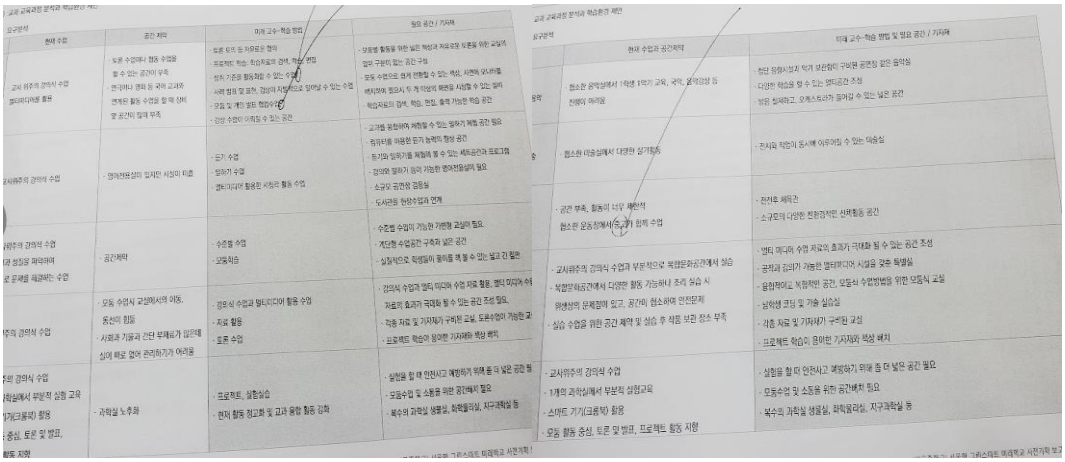
Extended Engagement (July 5th - 19th): The third phase was characterized by sustained interaction with the faculty members and the architect. This involved brainstorming future school directions, teaching methodologies for each subject, and collecting subjective responses via Google forms. This strategy enabled the gathering of diverse perspectives on the proposed changes.

Consensus Building (July 20th): The fourth visit facilitated a faculty-wide discussion about the data collected via Google forms, aimed at reaching a consensus on the proposed changes.

Agreement Review (August 30th): This phase involved revisiting the agreed-upon content with the Teacher TF team, allowing for revisions and ensuring a clear shared vision.

Classroom Needs Consideration (September 28th): The sixth visit revolved around discussing the classroom requirements based on the agreed-upon content. It was a critical step towards envisioning the necessary spaces for facilitating the new teaching-learning methodologies.

Implementation Planning (October 19th): The final visit involved planning new lessons in the newly designed classroom with all staff members. This planning session was an integral step toward implementing the HSCS, integrating the findings and agreements reached in previous visits.



[Fig.2] Photos of Data used for Consultation

The entire research process was conducted with rigorous ethical considerations, ensuring participants' informed consent, privacy, and confidentiality were upheld. Throughout, the study aimed to illuminate the complex realities of implementing an innovative curriculum within a reimagined educational space, while maintaining the integrity and authenticity of the research process[9].

4. Result

4.1 Differences in Preferred Teaching-Learning Methods by Grade

In the course of examining the implementation of the HSCS, significant variation was observed in the preferred teaching-learning methods across different grades. These disparities appear to be intimately connected with the distinctive needs, interests, and scholastic commitments of students in each grade level.

Students in the first year exhibited a marked predilection for project-oriented learning and instructional methodologies. This tendency is likely attributable to the uniform curriculum framework at this level, wherein all pupils engage uniformly across the same suite of subjects. Therefore, project-based instruction emerged as a vital learning strategy for students in their initial high school year, offering an avenue for them to investigate into and collaboratively explore fundamental concepts.

I would like to see less lecture-based classes and more activity-based classes with discussions, group work, etc. (Student A)

Conversely, students in the second year indicated data research, presentations, and project learning methodologies as their preferred methods. Considering the rise in elective subjects during the second year, students are afforded increased opportunities to express their individual competencies and talents. As a result, instructional methodologies that nurture critical thinking and creative capacities, such as research and presentations, are highly valued at this stage.

I would like the class to be more student-centered, with more time for presentations, discussions, and paired conversations about the material. (Student B)

Third-year students, who are at the juncture of preparing for university entrance examinations, perceived lectures and independent study as the paramount teaching-learning strategies. These methods correspond with the need for comprehensive comprehension and mastery of concepts examined within the university entrance examinations. As such, traditional lecture-based instruction, in conjunction with independent study, is perceived as indispensable for third-year pupils.

Please organize and conduct university entrance-oriented classes for third-grade high school students in a lecture format. (Student C)

In essence, the preferred teaching-learning methodologies across the grades manifest a trajectory from lecture-based and small group learning during the first year, transitioning towards more active learning approaches like presentations and project-based learning in the second year, and reverting to lecture-based instruction and independent study during the final year. This transition suggests a dynamic interplay between pedagogical strategies and the fluctuating academic needs, interests, and commitments of students as they navigate through their high school journey. The HSCS, endowed with its inherent flexibility and adaptability, seems well-equipped to accommodate these divergent preferences in teaching-learning methodologies.

4.2 Preferred Teaching-Learning Methods by Subject

Insights into the preferred teaching-learning methods and associated spatial needs across different subjects showcased the vast assortment of pedagogical strategies employed within the high school environment. In the subject of Korean, an emphasis was placed on free discussions, project-oriented learning, achievement standard-focused classes, and student-led presentations and expressions. The need for these various methods necessitated a flexible learning environment that accommodated collaboration, project work, and individual or group presentations.

For English, there was an observable shift away from traditional lecture-style classes towards presentation-centric instruction. A significant pedagogical strategy included the integration of cross-disciplinary learning through English passages or reading original books associated with contents from history, social studies, and science. A learning environment conducive to dialogue, presentations, and immersion in English materials would facilitate this approach. Mathematics exhibited grade-specific variations, with collaborative and presentation-based instruction favored by 1st and 2nd graders, while traditional lecture-style classes were the preference for 3rd graders. This duality was reflective of the divergent requirements of students at each stage. Additionally, the increased integration of digital devices and artificial intelligence for problem-solving tasks and discovery learning necessitated learning environments equipped with smart device capabilities.

Social Studies stressed interactive and cooperative classes, usage of electronic devices, and reading-oriented classes. Despite this, the necessity for lecture-style classes in preparation for university entrance exams was acknowledged. Moreover, the potential for convergent classes in relation to other subjects suggested a need for spaces that supported multidisciplinary learning. Science instruction required a unique amalgamation of spaces due to the integration of lectures, experiments, presentations, and discussions. Thus, it was critical to accommodate each of these activities within individual science rooms. Furthermore, due to safety considerations and the magnitude of certain activities, larger spaces were needed, complemented by spaces that facilitated collaboration and discussion.

Music necessitated a room furnished with advanced sound facilities and storage for musical instruments. This space also had to be multifunctional to meet various learning styles and needs, such as orchestras requiring more extensive spaces and comprehensive soundproofing. In Art, fostering motivation and creativity was achieved through resources like three-dimensional printers for sculpting, coupled with practical needs such as sink spaces in art rooms. Physical Education demanded large-scale facilities like a gymnasium for an array of indoor sports activities and smaller areas for individual or small-group activities. Technology-oriented classes required multimedia facilities for both crafts and lectures. A specialized room or makerspace would facilitate the convergence of different subjects and methodologies, group learning, coding, and project-based learning with a variety of materials and equipment.

These subject-specific preferred teaching-learning methods highlighted the need for a diverse range of learning spaces. Such environments should support different learning styles, encourage both individual and collaborative work, meet practical requirements, and provide the necessary technology and equipment. Given the inherent flexibility of the HSCS, schools are well-positioned to tailor their spaces to these diverse learning needs and preferences.

4.3 Subjects Requiring Special Rooms

To ensure optimal learning outcomes and accommodate the varied teaching-learning methods identified, it became evident that certain subjects demanded distinct, specially designed spaces. Science classes necessitated a multifunctional environment due to the unique teaching-learning approaches employed, including lectures, experiments, presentations, and discussions. Science laboratories, equipped with preparation rooms and dedicated spaces for lectures and discussions, were required to facilitate safe and efficient execution of experiments. These environments provided an effective arena for students to actively and safely explore scientific concepts.

Music classes called for a room resembling a concert hall, outfitted with advanced sound facilities and storage for musical instruments. This distinct space facilitated a broad range of musical activities, from individual practice to ensemble rehearsals to performances, thereby enriching the learning experiences of students. Art classes required a specifically designed room to cater to students working on various projects. This entailed access to contemporary tools like three-dimensional printers for sculpture creation and practical amenities such as sink spaces. Physical Education needed both a large-scale gymnasium for various indoor sports activities and smaller spaces for individual or small-group fitness activities. These spaces afforded students a wide range of opportunities to explore different types of physical activities and sports. Technology classes demanded specialized spaces, or makerspaces, equipped with multimedia facilities for both crafts and lectures. These rooms needed to support a range of activities, from individual coding projects to group-based design and building tasks.

Given the diversified teaching-learning methods and the unique requirements of different subjects, the significance of these specialized rooms became apparent. By creating dedicated learning spaces that bolster and enhance subject-specific learning activities, schools can more effectively engage students, facilitate active learning, and ultimately enhance educational outcomes. The challenge then resided in

designing these specialized rooms in a manner that aligned with the principles of the HSCS and the vision of the Green Smart School initiative.

4.4 Classroom Planning for the High School Credit System

The task of designing classrooms for the High School Credit System (HSCS) necessitated taking into account the distinct requirements of each grade and subject. This raised important decisions, notably regarding whether to implement a full subject class system (where students moved between different classrooms for all subjects) or a partial subject class system (where common subjects were taught in a single classroom and students moved classrooms only for elective subjects). Given the distinct teaching-learning methods preferred by each grade level, a partial subject class system was viewed as more advantageous.

It was a decision rooted in practical considerations: by confining each grade level to a single floor and accommodating multiple subjects within that same floor, students' transit times could be reduced. The decision also stemmed from an appreciation of the unique educational needs and preferences of students at different grade levels. For instance, while first-year students might prefer project-based learning and open discussions, third-year students, with the college entrance examination looming, might value a more structured, lecture-based approach that assures comprehensive coverage of the curriculum. Thus, the choice of a partial subject class system allowed for a certain degree of stability, while also ensuring the flexibility needed to meet the diverse learning needs of students across different grades.

This practical arrangement necessitated the creation of specialized rooms differentiated more by function rather than by subject. These included 'expression rooms', 'workrooms', and 'physical activity rooms', each designed to cater to a specific set of educational needs.

'Expression rooms', designed for classes requiring a high degree of self-expression and potentially generating significant noise, resembled traditional music rooms but were not limited to music instruction. Subjects such as Music, Korean, and English, particularly activities like drama, speaking, or other forms of self-expression, found their home here. For example, in a Korean drama class, students could rehearse and perform scenes or plays in a space designed to accommodate both the volume and movement associated with such activities.

On the other hand, 'workrooms', conceptually akin to smart maker spaces, were conceived to encourage creative, hands-on activities across various subjects. These included Art, where the space could be used for three-dimensional sculpture creation with 3D printers, Technology, which could benefit from a practical environment for coding projects or building tasks, and Science, where practical scientific explorations and small-scale experiments could be conducted. These rooms were furnished with an array of resources and tools, facilitating a diverse range of educational activities.

'Physical activity rooms' were envisioned as an evolved version of traditional indoor gyms, with their purpose extending well beyond Physical Education. Designed as a multi-use space, they could accommodate a variety of physical activities. From traditional gym classes to yoga, dance, martial arts, or other forms of physical movement, the space was versatile. It could also house certain science experiments that required more room or involved movement. Furthermore, during breaks, the room could transform into a recreational space, allowing students to engage in activities promoting physical fitness and well-being.

By identifying the necessity of each of these specialized rooms and the variety of classes that could be conducted within them, it became possible to design a learning environment that effectively supported the HSCS. These spaces were not simply rooms; they were versatile environments that catered to the unique learning needs of the students, promoting active learning and engagement. The creation of such diverse learning environments also aligned with the broader vision of the Green Smart School

project, embodying its principles of interdisciplinarity, flexibility, and environmental sustainability. Ultimately, the goal was to foster an educational ecosystem that could adapt to the changing needs of learners, preparing them not just for examinations, but for the challenges and opportunities of the future.

5. Conclusion

This study was initiated at the intersection of two significant advancements in the realm of education: the Green Smart School Project, aimed at rejuvenating outdated schools into high-tech, eco-friendly educational spaces, and the HSCS, infusing a heretofore unseen flexibility and customization into the South Korean education system. These two revolutions provide a precious chance to reconsider how high school education is imparted, even as they pose formidable challenges. This study endeavored to chart a course through these challenges by examining favored teaching-learning methods across different grades, evaluating the spatial necessities of various subjects, and discerning the necessity for specialized learning spaces.

The finding unearthed an intricate network of preferences and requisites, which demonstrated substantial variation contingent on the grade level. Freshmen displayed a predilection for project-based learning, an interactive strategy emphasizing problem-solving and teamwork. Sophomores leaned towards a mix of presentations and project learning, hinting at the necessity for an environment conducive to independent exploration, data assessment, and public discourse. Seniors, faced with the imminent prospect of college entrance examinations, gravitated towards conventional lecture-based learning and self-study, favoring a structured method that guarantees thorough coverage of the syllabus.

This diversity dictated a nuanced approach to organizing learning spaces. Acknowledging the differing learning inclinations across grades, a partial subject class system was proposed, wherein common subjects would be taught in one classroom and students would transition to different classrooms for elective subjects. This system harmonizes the demands for consistency and stability with the flexibility needed to cater to the heterogeneous learning needs of the students.

Investigating the subject-specific necessities, the study spotlighted an array of spatial and facility demands. For instance, science subjects necessitated areas equipped for a blend of lectures, experiments, presentations, and discussions, mirroring the multi-dimensional character of scientific exploration. Conversely, arts and technology subjects required specific apparatus and materials, like 3D printers for sculptural tasks in art and multimedia facilities for technology subjects.

In view of these findings, the establishment of specialized classrooms can be suggested - specifically 'expression rooms', 'workrooms', and 'physical activity rooms'. 'Expression rooms' were conceptualized to facilitate classes that demand self-expression and the generation of noise, such as drama in Korean classes and speaking exercises in English classes. 'Workrooms', reminiscent of smart maker spaces, were designed to aid practical, hands-on work across diverse subjects. 'Physical activity rooms', akin to traditional indoor gyms, were designed to provide a venue for physical education and other movement-based activities.

These specialized classrooms signify more than mere functional learning spaces. They embody an educational ethos that esteems interdisciplinary learning and innovation, in harmony with the Green Smart Project's spirit. By enabling diverse learning experiences, these classrooms can nurture the growth of innovative, critical, and adaptive thinkers, better prepared to flourish in an increasingly complicated world.

The impact of this research transcends the boundaries of the classroom. It proposes a radical overhaul of the entire school's structure, suggesting that different floors should be assigned to different grade levels, reflecting the disparate needs of students at various stages of their educational journey. Such a spatial arrangement allows for more efficient student movement and a more targeted distribution of resources, enhancing the overall efficacy of the educational experience.

To conclude, this investigation contributes a much-needed blueprint for re-imagining high school education in light of the Green Smart Project and the HSCS. It suggests that by aligning the physical surroundings with the educational objectives, schools are constructed that not only prepare students for examinations but also for lifelong learning. There are limitations in this study that it does not show how learning environments organized through Green Smart Project are actually being used in schools. Therefore, it is necessary to present specific examples of how such learning environments are being utilized under the HSCS system. However, the findings of this investigation should not be seen as a final destination, but rather a launchpad for future research. It's essential to examine the practical aspects of implementing these recommendations, continue refining the model based on teacher and student feedback, and rigorously.

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