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Implementing the Green Smart Initiative: An Action Research on Spatial Planning in Response to Comprehensive Educational Objectives

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Abstract: The need to adapt school architecture with a forward-thinking approach is widely recognized, but the transformation of existing buildings poses significant challenges regarding resources and time. However, as aging school facilities reach their limits and require reconstruction, these efforts become increasingly urgent. This research aimed to examine the implementation of the Green Smart School initiative at Saebom Elementary School, focusing on reconfiguring educational space to enhance learning environments regarding sustainability and innovation. The study drew upon action research methods, involving direct engagement with school members, analysis of previous educational objectives and programs, identification of problems, and development of effective solutions. This research involved four integrated phases: planning, acting, observing, and reflecting, which included two workshops and one online survey at Saebom Elementary School in Seoul. Key findings from the study include recognizing the need for strategic spatial organization in alignment with core educational competencies. This organization was evident in the focus on reading education, smart education, and rich cultural education as primary tasks. Further, the study explored the importance of collaboration and interaction in student engagement and active learning. The findings suggested that dedicated learning spaces, equipped with interactive digital tools such as interactive whiteboards and tablets, could facilitate collaborative projects and group discussions. Lastly, the study emphasized the importance of communal spaces such as hallways, passageways, and gardens. The innovative transformation of these spaces into multi-purpose areas could enhance overall space utilization and provide opportunities for rest, social interaction, exhibitions, and relaxation. In conclusion, this research provides an insightful case study into how the Green Smart School initiative is operationalized within a specific educational context. It underscores the importance of aligning spatial organization with educational goals and content to facilitate effective learning.

Keywords: Curriculum Integration, Curriculum Planning, Educational Planning, Flexible Learning Spaces, Green Smart School Initiative

1. Introduction

The recognition of the necessity to adapt school architecture with a forward-thinking approach is widespread, although the transformation of existing buildings presents significant challenges regarding resources and time. Nevertheless, these efforts become urgent when aging school facilities reach their

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limits and require reconstruction. The Green Smart Schools Initiative in South Korea represents a national endeavor aimed at renovating evolving and aging school buildings by incorporating forward-looking principles into their design.

The benefits of the Green Smart School initiative in South Korea are diverse. Primarily, these schools of the future seek to provide an enriched educational experience that equips students with the knowledge and skills to navigate a rapidly evolving world. By promoting environmental stewardship and technology literacy, Green Smart Schools prepare students to address complex environmental challenges and adapt to a technology-driven society.

South Korea's Green Smart School initiative endeavors to seamlessly integrate environmental sustainability and advanced technology into the design and operation of educational institutions. This program is a pioneering effort to develop sustainable and technologically advanced educational environments by enhancing environmental awareness, promoting energy efficiency, and recognizing the crucial role of schools in preparing students for a sustainable future.

Green Smart Schools also leverage advanced technology to enhance the learning experience. Equipped with state-of-the-art digital tools, interactive displays, and smart devices, these schools foster interactive and personalized learning. Integrating technology not only facilitates innovative teaching methods but also promotes digital literacy and equips students with the skills required for the digital age.

South Korea's Green Smart School initiative embodies a forward-looking approach to education that harmoniously combines environmental sustainability with advanced technology. Green Smart Schools prioritize green infrastructure, digital innovation, and environmental education to create optimal learning environments that prepare students for a sustainable future. The adoption of the Green Smart School model exemplifies South Korea's commitment to fostering environmentally conscious citizens and building a more sustainable society.

This study aimed to illustrate the transformative changes that occur in target schools when implementing the Green Smart School program in South Korea. Specifically, the focus of this study was to showcase exemplary development processes and outcomes that connect educational goals, content, and school members' needs with spatial design in the process of the Green Smart School initiative. This study serves as a valuable blueprint for other schools embarking on similar initiatives, demonstrating the potential for enhancing student engagement, fostering interdisciplinary connections, and supporting a diverse range of learning activities through strategic space utilization.

2. Theoretical Background

One prominent area of investigation focuses on the impact of school design and layout on student engagement and learning. Numerous studies have demonstrated the significance of factors such as classroom size, seating arrangements, and lighting conditions in affecting student attention, motivation, and academic performance. For instance, research indicates that smaller class sizes and flexible seating arrangements promote collaboration, interaction, and student-centered learning approaches. Additionally, the presence of natural light and well-ventilated spaces has been linked to improved cognitive functioning and overall well-being.

Another key aspect explored in academic research is integrating technology in school spaces. Studies have shown that the strategic incorporation of technology-enabled spaces, such as multimedia classrooms and maker spaces, can enhance student creativity, problem-solving skills, and digital literacy. These spaces not only support technological advancements but also foster innovative teaching practices and enable personalized learning experiences.

Moreover, school space planning research emphasizes the importance of creating flexible and adaptable learning environments. Educational institutions are recognizing the need for spaces that can

accommodate evolving pedagogical approaches, diverse student needs, and changing curriculum requirements. This necessitates the design of multipurpose areas that can be easily reconfigured, collaborative spaces that facilitate teamwork, and communal spaces that promote social interaction.

The academic research on school space planning also underscores the significance of incorporating sustainability principles into the design and construction of educational facilities. Environmental considerations, such as energy efficiency, waste reduction, and the use of eco-friendly materials, are essential in creating sustainable and healthy learning environments. Green infrastructure, such as gardens and outdoor learning spaces, further enhances the connection between students and the natural environment, promoting environmental awareness and well-being.

Exemplary studies are introduced as follows. [1] reveals that classrooms with natural light, good air quality, and appropriate thermal comfort positively influence students' learning outcomes. The study emphasizes the importance of considering environmental factors in classroom design to support student success. [2] introduces the concept of the environment as the third teacher and highlights the significance of incorporating flexible spaces, natural light, color, and interactive displays to facilitate effective learning experiences. This publication underscores the role of physical spaces in promoting student engagement and collaboration. Examining the impact of school architecture on academic achievement, [3] finds that well-designed school environments contribute to improved student performance. Their research emphasizes the importance of thoughtful architectural considerations in promoting educational success. [4] also investigates the effects of the physical classroom environment on academic engagement and achievement in early elementary school. Their findings suggest that characteristics such as natural light, comfortable temperature, and varied learning spaces positively influence student engagement and academic outcomes, highlighting the importance of a conducive physical environment for learning. [5] explore the impact of classroom design on learners' educational outcomes, including academic progress, well-being, and behavior. Their research underscores the significance of features such as flexible seating, access to nature, and personalized learning spaces in promoting positive educational experiences and improved learning outcomes for students. These studies reveal that well-organized spaces and appropriate seating arrangements positively affect learners' performance. [6] found that classrooms with natural light, good air quality, and optimal thermal comfort positively influence students' academic performance.

In addition to physical design considerations, research also explores integrating technology and the creation of flexible and adaptable learning environments. Strategic incorporation of technology-enabled spaces, like multimedia classrooms and maker spaces, enhances students' creativity, problem-solving skills, and digital literacy. Moreover, the importance of sustainability principles in school space planning is emphasized, with energy efficiency, waste reduction, and the use of green materials contributing to sustainable and safe learning environments.

While existing research provides valuable insights into the factors that influence education through building design, there is a limited discussion regarding how buildings should be composed based on the educational purpose. The Green Smart Project aims to address this gap by designing appropriate educational environments focused on educational goals, content, and methodologies. This study intends to explore the architectural styles necessary to achieve these objectives by analyzing the purpose, content, and methods of education. By doing so, it seeks to contribute to the ongoing efforts to optimize the learning environment and promote student success.

3. Research Methodology

3.1 action research methodology

Action research, distinguished by its practical, cooperative, iterative, and reflective characteristics,

presents an efficacious methodology for addressing complex issues within educational contexts[7]. This method is noted for its cyclical structure encompassing four integrated stages: planning, acting, observing, and reflecting. These stages ensure the learnings from each step inform the subsequent one, thus promoting a continuous process of improvement[8].

In the planning phase, researchers identify concerns, collate relevant data, and develop a tactical plan of action. The acting phase involves implementing the proposed strategy, while the observation phase is devoted to gathering data and assessing the effectiveness of the actions taken. In the reflection phase, researchers critically examine the collected data, evaluate the efficiency of their interventions, and enhance their understanding of the problem. This recursive process is particularly pertinent to curriculum studies that necessitate educators to adapt and respond to changing needs and circumstances.

Collaboration and participation form the bedrock of action research. This approach underscores the value of involving all key stakeholders, such as teachers, students, administrators, and parents, in the research process. Through the inclusion of diverse perspectives, action research nurtures a shared sense of ownership and responsibility for the research outcomes, fostering more sustainable and effective changes in educational practices. In curriculum studies, such collaborative engagement can encourage the development of curricula that are better aligned with the diverse needs and preferences of learners.

Another pillar of action research is stakeholder empowerment. By actively engaging stakeholders in the research journey, action research empowers them to gain a comprehensive understanding of the relevant issues and acquire the necessary skills and knowledge for addressing these issues. Empowerment is particularly significant in educational settings, where teachers and students often encounter feelings of disempowerment due to top-down decision-making structures and standardized curricula [9]. Action research in curriculum studies can help reverse this trend by empowering teachers and students to actively shape their learning experiences.

Finally, action research is recognized for its focus on practical problem-solving. It rests on the belief that research should be relevant and applicable to real-world situations, resulting in tangible improvements in practice. In the realm of curriculum studies, this implies that action research should be aimed at addressing specific issues or challenges related to curriculum design, implementation, or evaluation, with the overarching goal of enhancing teaching and learning processes.

The methodology and orientation of this research align ideally with the educational planning requirements of the Green Smart Project. The study was carried out employing the methodology and skillset of action research, including stakeholder interests, school context, action plans, collaborative negotiation outcomes, and iterative adjustments and observations.

3.2 Data Analysis

The process of gathering data in the action research study incorporated into Saebom(pseudonym) Elementary School's Green Smart Project utilized diverse methods to procure valuable insights from teachers and parents. Initial steps involved visits to the school which served to foster relationships with participants and provide an outline of the project. Such visits promoted direct communication, providing the researchers an opportunity to elucidate the study's objectives and advocate for dynamic participation.

Two major data acquisition events were orchestrated, constituting two workshops: the inaugural one was scheduled on Tuesday, January 31, 2023, at 4:30 pm, while the subsequent workshop took place on Wednesday, February 8, 2023, at 2:00 pm. Throughout these sessions, the entirety of the school's teaching staff and a handpicked assembly of parents congregated to exchange ideas and perspectives concerning the future trajectory of the school. These workshops fostered an interactive environment for comprehensive dialogues, thereby enabling attendees to offer qualitative insights about curriculum transformations, the roles assumed by teachers, and the overarching purpose of the school.

[Fig. 1] Photos of Saebom School: Old Buildings Need to be Rebuilt

Complementing the workshops, an online survey was administered from February 1 to 7, 2023. The survey's construction was informed by feedback and input procured during the workshops, which confirmed that it encompassed explicit areas of interest underscored through the direct exchanges. Utilizing the reach of digital platforms, the researchers were able to engage a broader spectrum of parents and procure quantitative information reflecting their views and preferences.

Across the span of the data-gathering phase, the emphasis was placed on ethical imperatives, asserting participant confidentiality and procuring informed consent. Procedures were instituted to safeguard participant privacy and to manage the acquired data securely. Information procured from both the workshops and the online survey was meticulously handled and preserved for ensuing analysis.

To encapsulate, the data acquisition techniques utilized in the action research study at Saebom Elementary School's Green Smart Project encompassed school visits, two workshops, and an online survey. These strategies facilitated a holistic approach to procuring insights from teachers and parents, amalgamating qualitative and quantitative information. Throughout the procedure, adherence to ethical standards was maintained to ensure the confidentiality of participants and the security of the data.

4. Result

4.1 Vision Reset

The outcomes of the research offered a comprehensive account of the vision restructuring, which was undertaken to chart out the future of Saebom elementary school. This process entailed a thorough reassessment of prevailing objectives, a probing examination of future educational targets, and a contextual evaluation of the school's extant aims. The intent was to pinpoint the future skills and competencies the school community aspired to foster in its students.

The existing objectives of the school were firmly embedded in principles such as creating an "education environment filled with dreams, love, and happiness" and developing "creative, convergent learners poised for the future." School members wanted to ensure that these principles remained the foundation for the future school's educational initiatives. Furthermore, the research marked out key capabilities required for future schools, encompassing creative cognition, data and information processing, community involvement, independent learning, aesthetic sensibility, and cooperative communication.

I would like to keep our school's current vision alive
because happy education is important in elementary school. However, I hope to develop

it further by connecting with the future core competencies. I think students need skills like data literacy and creative thinking. (Teacher A)

Considering these findings, the research led to the establishment of a forward-looking vision for the school: "To construct a vibrant learning community devoted to nurturing creative, socially conscientious individuals possessing essential skills and competencies for success in an increasingly dynamic world." This vision was devised to act as a principal guiding post for setting objectives at each educational level.

In harmony with this future-oriented vision, specific objectives were devised for each grade level, with due consideration given to the student's developmental needs and abilities. These objectives spanned various realms, including academic accomplishment, character growth, socio-emotional development, and the mastery of 21st-century skills. The results of this research underscored the school's commitment to delivering a comprehensive, future-oriented education, with the ultimate aim of empowering students to excel in a rapidly evolving societal context. The outcomes of this research not only illuminated the vision restructuring process but also indicated the anticipated future course for the school. The identified capabilities and objectives laid the groundwork for an integrated and progressive educational approach. The research outcomes stressed the critical importance of preparing students with the necessary skills and competencies to successfully navigate future challenges and opportunities.

4.2 Specific Plan

The research presented an ambitious vision and goals for the school, highlighting a comprehensive approach to education that encourages creativity, cooperation, and active participation. Key competencies were identified, including creative thinking, information processing, community engagement, self-initiative, aesthetic sensitivity, and cooperative communication.

The intended outcome was to foster creative and convergent thinking skills among students, nurturing a love for learning, respect for others, and a commitment to sustainable development. The primary objective was to prepare students for the future by building upon their dreams and fostering cultural richness, art appreciation, and sensitivity.

Various educational initiatives were proposed to achieve these goals. These educational initiatives included after-school programs linked to the curriculum for the lower grades, reading-focused care-based classes, and education targeting basic academic skills. The aspiration was to create a safe and joyful school culture that promotes community spirit and ecological awareness through transformative experiential education.

Our school needs more diverse after-school programs. There are students who have been in the care-based classroom for a long time, so it would be even better if these children spend meaningful time in the care-based classroom. (Teacher B)

In addition, the research endorsed an education system that fuels boundless imagination, cultural understanding, and diverse talents, as well as creative convergence education for students in grades 3-6. To revitalize information education, personality education centered around environmental issues, and education for sustainable development was also given priority.

To support these initiatives, specialized programs such as reading education, AI specialization, garden schools, and communication spaces in the cafeteria were proposed. Furthermore, art programs, recreational sports, baseball specialization, and the reinforcement of newly established strengths were emphasized to provide students with comprehensive experiences and opportunities for personal growth.

In sum, the research outcomes painted a wide and inclusive vision for the school, focusing on fostering creativity, active participation, and sustainable development. The proposed initiatives aimed to equip

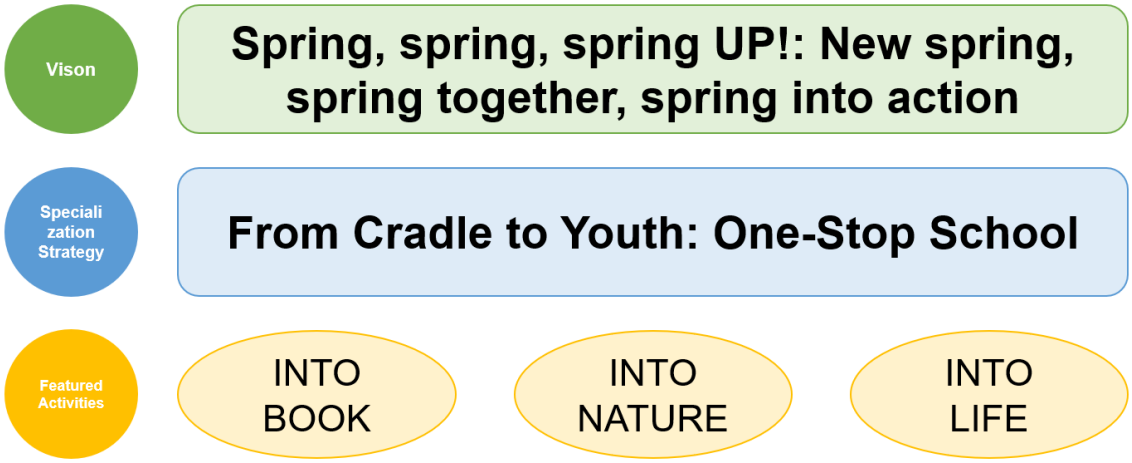
students with the skills, knowledge, and values needed to succeed in an ever-evolving world. By embracing these goals and implementing the recommended educational programs, the school plans to create a vibrant and nurturing learning environment that empowers students to reach their full potential.

4.3 Addressing Overcrowding and Population Decline: A Specialization Model

Saebom Elementary School confronted a unique predicament with the high number of working parents owing to the numerous large corporations in the proximity, compounded by a swift decline in the local population that resulted in a drop in student enrollment. In contrast, adjacent elementary schools were dealing with an overflow of students due to the necessity of childcare within apartment complexes. Saebom Elementary School perceived these conditions as a beneficial chance to mitigate the overcrowding challenges.

To navigate these issues and deliver a distinct educational paradigm, the school devised a strategy named "From Cradle to Youth." This approach was intended to construct a secure and comprehensive educational milieu where students could extend their education beyond typical school hours. Moreover, a plan to form a joint school district was advanced, fostering cooperation with a nearby school to maximize the utilization of resources and enrich the educational opportunities available.

To counter the congestion in neighboring schools, the inception of a kindergarten program was proposed. This strategic initiative was designed to cater to the requirement for childcare services and deliver relief to surrounding schools grappling with space constraints. By broadening the span of educational services from early childhood to adolescence, Saebom Elementary School sought to serve the community more effectively and address the necessities of students and families in the region.



[Fig.2] Screenshot of the Result Summary Page

In summary, Saebom Elementary School devised solutions to the problems posed by population decrease and overcrowding in nearby schools by adopting a specialized model. By endorsing the "From Cradle to Youth" concept and forming a joint school district, the school sought to deliver comprehensive education and alleviate overcrowding strains within the local vicinity. Through these endeavors, Saebom Elementary School underscored its commitment to fulfilling the educational requirements of the community and ensuring a secure and supportive learning environment for all pupils.

4.4 Education Plan and Space Example:

In response to Saebom Elementary School's aspirational vision, an instructional blueprint was

formulated to engender an active and immersive learning setting. This strategy comprises curricular tactics, bespoke operational tactics, and the delineation of distinct spaces to bolster the vision.

As a component of the curricular tactics, amalgamation with the curriculum was given primary consideration. After-school programs were envisioned to dovetail with the standard curriculum, offering students supplementary avenues for in-depth exploration and application of their learnings. Additionally, fundamental academic skills were to be underscored via elementary academic responsibility education. Creative convergence education was intended to be woven into the curriculum to foster creative and integrative thinking abilities among students. For bolstering students' digital literacy, the activation of information education via platforms such as metaverse and coding was considered.

Regarding bespoke operational tactics, certain spaces were slated for an establishment to foster distinct learning experiences. Science inquiry rooms were envisaged to offer students opportunities for scientific exploration and discourse, fostering an experiential approach to learning. Creative convergence classes were planned to focus on project-centric activities and creative output, igniting students' creative and convergence thinking. Active rooms, conceived as versatile spaces, were intended to stimulate play, hands-on learning, and physical activities. Technologically advanced classrooms were planned to be set up to facilitate coding and computing education.

To designate spaces that resonate with the vision, various areas were projected to be repurposed to cater to specific functionalities. An urban garden school was intended to provide a natural and immersive learning space. The cafeteria was planned to be utilized as a communication and social interaction hub, thereby fostering a sense of community among the students. Clubs and activities, both subject-oriented and non-subject-oriented, were set to be introduced to boost community engagement and cultivate students' unique interests and talents. Specialized areas such as a smart gym, music room, audio-visual room, art room, cooking room, and active room were intended to be allocated to foster emotional learning and the growth of aesthetic and cooperative communication skills. Students can display works created in these spaces using common areas such as hallways, passages, and gardens. In addition, students can build humanities knowledge in the library space shared with the local community, and career exploration activities based on reading are also possible.

Overall, this plan was devised to forge a stimulating and innovative learning atmosphere where students can develop their creativity, hone key competencies, and prepare for a promising future.

5. Conclusion

This study was aimed at showcasing the execution of the Green Smart School initiative in an elementary school context, with a focus on space utilization for fostering innovative and sustainable learning environments. The action research was carried out at Saebom Elementary School, where the process entailed engagement with school members, examination of past educational goals and programs, problem diagnosis, and problem-solving approach identification. The results underscored strategies for cultivating future core competencies, with reading education, smart education, and cultural enrichment being identified as the primary tasks. Nevertheless, reconfiguring space is required to facilitate such education. The study also explored the spatial design needed following the new educational goals and programs.

The findings emphasized the significance of developing multipurpose classrooms, encouraging collaboration and interaction, allotting spaces for specific educational aims, and maximizing the utilization of common areas. It was also noted that the diversification of general classrooms through features such as movable walls, modular furniture, and flexible seating arrangements can enhance the versatility of learning spaces, thus facilitating smooth transitions to accommodate various educational activities. Such an approach aids in fostering interdisciplinary connections and creativity among students.

Fostering collaboration and interaction was recognized as critical for student engagement and active learning. The study concluded that establishing dedicated learning spaces equipped with tools such as interactive whiteboards, tablets, and other digital instruments could facilitate collaborative projects, discussions, and group work.

Furthermore, allocating spaces for each teaching and learning method, as opposed to creating subject-specific classrooms, enables the provision of a suitable environment for specific activities. By forming practice spaces, collaborative project spaces, and creative expression areas, the school can support the development of professional skills and cater to a diverse set of learning needs.

The study also proposed ideas for communal spaces, suggesting the transformation of hallways, passageways, and gardens into multipurpose areas to increase space utilization and provide opportunities for rest, social interaction, exhibitions, play, and relaxation. This approach aids in maximizing the use of available resources and contributes to creating an active and inclusive learning environment.

In essence, the Green Smart School initiative, with its emphasis on space utilization, is geared towards the creation of innovative and sustainable educational environments. By embracing flexible and versatile design principles, encouraging collaboration, and maximizing the use of common areas, schools can create inspiring spaces that foster student engagement, promote interdisciplinary connections, and support a wide range of learning activities.

Since the study was conducted at the elementary school level, there are limitations to the implications for other school levels. There is a need for further discussion related to the 'free semester system' in middle school and the 'high school credit system' in high school, which are emphasized in the new curriculum. However, this study sought to elucidate the direction of the project by offering an example of the Green Smart School Project's progress in a specific school. While the creation of space can facilitate education, the crux of this project lies in identifying the necessary educational purpose, the accompanying educational content, and characteristics, and finding a space appropriate for these elements. This study holds significance in illustrating such a process.

Acknowledgments

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