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Developing Collaborative Governance Service Design to Build a Community-based Culture of Children's Safe Routes to School

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Abstract

The safety service design policy for children's school zones aims to minimize risks for child pedestrians, who are more vulnerable to accidents than adults. This study presents an implementation plan from a collaborative governance perspective, focusing on building a safety culture for children's school zones. Research methods included literature review, case analysis, and field data collection. Case studies covered child, traffic, and school safety across sectors like corporations, academia, and local governments, identifying implications for community-based design. Empirical research involved four workshops with stakeholders to map routes, identify risks, and collect needs. Practical solutions were developed using a checklist and prototype, then implemented. The study highlights the value of engaging communities in fostering safer school routes through collaborative workshops, prioritizing needs, and proposing user-centered solutions. This community-led approach offers sustainable, realistic alternatives to enhance children's road safety. The findings were initially shared at ISAAC 2024 and expanded with further research.

Keywords: Safety design, Community, Service design, Collaboration, Governance

1. Introduction

In 2022, traffic accidents were the leading cause of child safety accident fatality rate. This was much higher than other types of accidents such as falls, drowning, fire, and poisoning [22]. In response, the government is promoting various policies to protect children from the dangers of traffic accidents. In particular, it is expanding safety facilities in protected areas to strengthen the safety of young pedestrians and making various efforts to improve traffic culture. According to the Ministry of the Interior and Safety, it is currently planning a project to improve safety facilities to create safe school routes, with the goal of reducing the number of traffic fatalities to 0.3 per 100,000 children by 2026. Planning policies for children's routes to school need to consider the opinions of pedestrians and local communities to create optimal routes. This is where safety service design comes into play, an approach that goes beyond the concept of facilities and involves the people themselves in designing a safe commuting environment. Participatory safety service design means using service design

methodology to provide a service experience that enables young pedestrians to feel safe and minimize risk factors while walking.

Through this study, we propose a safety design service for children's school routes to suggest major policy directions for improving the transportation environment and specific implementation plans from the community perspective. The purpose of this study is to discuss service options to ensure children's safety and to provide practical solutions through service design with the direct participation of residents. As a result, it is expected that it will be possible to build a safety net for children's school routes by including physical environment and social safety activities that are directly related to the lives of residents.

This study is a combination of literature review, case analysis, and empirical study. First, a theoretical review of safety culture, safety design, collaborative participatory governance, and community-based service design was conducted. Then, the case analysis examined community-based service design cases that meet the following five conditions: 1. subject is children, 2. cause of accident is traffic safety, 3. facility type is educational facility safety, 4. space type is school safety, and 5. product type is service safety. Each case was divided into a corporate case, institution case, academic case, and local government case to examine the application of community-based safety service design for children who are vulnerable to pedestrian safety. The empirical study was conducted based on the data obtained from the field to design a service design and strategy. We selected Jangseong-gun, Jeollanam-do, and proposed a community-based safety service design in cooperation with residents for children's routes to school that are vulnerable to safety. This service design was implemented as a problem-solving design project in Jeollanam-do 2023 and utilized service design methodology in the process of deriving practical improvements. From August 28 to October 4, 2023, we conducted five face-to-face user surveys, held workshops to reflect user experiences, and conducted checklists to propose a prototype. In the process of policy formulation and implementation, residents were involved to derive realistic alternatives, and collaboration between project officials, relevant experts, and stakeholders from partner organizations was established to create a long-term sustainable collaborative governance plan.

2. Theoretical Background

2.1. Safety culture and life safety design

Safety is a relative concept which is the absence of danger or accident, and the fundamental right to safety is a prerequisite duty of the country [15]. A safety culture is a way of behavior or practice that helps prevent accidents. It can be said to be a total meaning of behavior, mindset, attitude, etc. to realize human dignity and value, and to ensure that ritual practices are codified into safety in all activities by being filled with the value of safety first. The three principles of safety management by definition of safety culture are primary change in behavior, establishment of safety-first values, and unconscious expression of safety consciousness [16]. The concept of safety culture was coined in the nuclear industry and first used in the Post Accident Review on the Cher Accident, a report by the International Nuclear Safety Advisory Group (INSAG) following the 1986 Chernobyl nuclear leak in the Soviet Union. The International Atomic Energy Agency (IAEA) has defined safety culture as the totality of organizational and individual characteristics and attitudes that should be given the attention commensurate with its importance [17].

Recently, the term "safety design" has been frequently used in the planning, design, and construction stages of public buildings and spaces in South Korea [9]. In Korea, the awareness of safety culture was low, but after the Sampung Department Store collapse on June 29, 1995, public interest in safety was raised, and government-led safety-related laws were enacted, emphasizing a safety culture related to building an efficient cooperation system. The concept of "life safety" emerged in order to overcome safety hazards and pursue safety. Life safety is the

promotion and guarantee of safety from the possibility of threats or threats to the living environment that we encounter in the course of our daily lives [7]. Kang (2016) categorized the types of life safety by considering various variables as shown in <Table 1> [8].

Table 1. Types of life safety according to various variables

Researchers	Research implications
Subjects	Child safety, elderly safety, women safety, disabled safety
Causes of accidents	Gas safety, electricity safety, elevator safety, transportation safety
Type of facility	Welfare facility safety, educational facility safety, cultural facility safety, amusement facility safety
Space type	Home safety, school safety, workplace safety, social safety, mountain safety, maritime safety
Goods Type	Product safety, service safety

In order to prevent accidents and damage from various hazards that can occur in daily life, the government and local governments are organically working together with personal safety through policies. Safety design, a concept introduced in Korea in 2009, refers to design that considers safety in everyday life and public facilities. The Ministry of the Interior and Safety defines it as "a design that is safe, beautiful, and easy to use" As shown in Table 2, the concept and role of safety design from previous studies are explained.

Table 2. Concepts of safety design

Year	Safety design concepts and roles
Ministry of the Interior and Safety (2009)	Creative and practical activities that combine aesthetic design and safety functions in facilities, products, and spaces related to public life to improve the level of social safety [25].
Yang (2011)	When designing products, facilities, and spaces, improve the safety of the main function considering the life cycle, and design that considers safety, ease of use, functionality, user characteristics, and aesthetics through synergistic convergence with other functions [13].
Yoon (2013)	The principle of designing to minimize the risk of dangerous actions or the consequences of unintended actions [3].
Choi (2020)	Aiming to design for safety, considering harmony with all environments, usability, and user emotions [9].

Safety design goes beyond simple aesthetic elements and aims to improve pedestrian safety and traffic conditions [4]. In this study, safety design for building a safety culture of children's routes to school is defined as 'a design that considers the risk factors that occur in facilities used by children in consideration of their usability'.

2.2. Collaborative participatory governance

As a result of the limitations of the new public management system, which resulted in the majority of the population being marginalized from public services, discussions began on a new system to strengthen government accountability and induce collaboration with citizens without leaving everything to market

principles. In the process, the concept of new governance or participatory governance was introduced, in which the government collaborates with citizens to actively listen to and reflect the opinions of civil society organizations, corporations, and residents throughout the entire state operation and invite them to participate in the policy process [18].

Participatory governance is a decision-making structure that brings together governments, the private sector, communities, and citizens in public policy and social problem-solving. This approach to governance emphasizes the importance of diverse stakeholders working together, and sharing their capabilities and resources to solve complex social problems.

It represents a shift in the relationship between the country, the market, and civil society, and a new way of coordinating to solve public problems through collective action. Collaborative governance can be understood through a common set of perspectives on governance [5]. As shown in Table 3, the paradigm shift in government operations provided by the Government 3.0 Service Guide is explained.

Table 3. Changing the paradigm of government operations [20]

Configuration	Government 1.0	Government 2.0	Government 3.0
Operational policies	Government-centered	People-centered	Individual-centered
Core values	Efficiency	Democracy	Extended democracy
Engagement	Government-led	Limited public participation	Active public participation, openness, sharing, communication, and collaboration
Administrative services	One-way delivery	Two-way delivery	Two-way personalized delivery
Means (channel)	In-person	Internet	Wireless internet, smart mobile

Source: Government 3.0 Service Alerts

According to the paradigm shift in government operation in <Table 2>, open and unique communication and cooperation are being emphasized, and administrative services are being provided in a two-way customized manner for issues that require public intervention. The effectiveness of the governance system has increased due to the government's role of supporting parties to solve social problems.

According to the principles of the collaborative economy, open assets have more value than closed assets. They are used more efficiently and we can plan and discover new uses for them. And when they are interconnected, the more people involved, the smarter the outcome [14].

Dunn(2014) identified the main characteristics of policy problems as interdependence, subjectivity, artificiality, and instability [10].

Currently, to solve these policy problems, a collaborative approach is being used to reduce conflicts of interest through the participation of various stakeholders, enhanced decentralization and transparency, and consensus among participants, and to implement long-term policies. Collaborative governance is characterized by mutual trust-building, communication, equal participation, and shared responsibilities and roles. This fosters mutual understanding and increases accountability for common goals, making policies more likely to be implemented.

2.3. Community-based service design

Community comes from the same root as 'common' and 'commual' which implies common ownership. As such, the community is about solidarity and cooperation among local members to pursue common interests [12].

Community design, a term that combines the concepts of community and design, is basically a community revitalization activity that combines the attributes of design to solve community problems and create new values in order to pursue common interests based on the relationality of participation and communication, which are the attributes of the community [11].

Service design is fundamentally based on user-centered design and is defined as a holistic approach to designing integrated strategies, systems, processes, and touch points that are user-centered and at the same time an iterative process that integrates multiple disciplines through design thinking [6].

While both community design and service design emphasize user experience and engagement, they can differ in their approach. Community design is centered around a specific community and aims to solve problems faced by its members and improve the environment to reflect local needs. Service design focuses on optimizing the interactions between users and service providers to create a better experience. Community design and service design create design principles and provide a structured framework. This allows for solving new challenges and promoting innovation across various fields [1].

Thus, community-based service design can be defined as a design approach that engages with residents to provide a better experience in order to solve a problem or advance the development of a particular neighborhood or community. It involves a design approach to planning and improving the entire experience of a service. Community-based service design emphasizes the importance of engaging residents in the design process to improve their living environment, strengthen local identity, and build collaborative systems to achieve common goals. It's about uncovering the hidden needs of users so that service improvements can be made, rather than a piecemeal collection of opinions.

Community-based service design is characterized by the participation of members from problem recognition to solution identification, reflecting their opinions and ideas to meet their needs.

3. Case Study

This study aims to investigate and analyze the design for school commuting safety among the life safety service designs. Therefore, among the types of life safety according to various variables in the theoretical review in Chapter 2, we selected cases that meet the following five conditions: 1. subject is children, 2. cause of accident is traffic safety, 3. facility type is educational facility safety, 4. space type is school safety, and 5. product type is service safety. The case analysis sample was divided into corporation, institution, academia, and local government cases to examine the application of community-based safety service design that enables children who are vulnerable to pedestrian safety to commute to school with peace of mind.

3.1. Corporation

Table 4. Noroo Paint safety service design

Classification	Analysis	
Coverage area	Green Road, Jeonpo 1-dong, Busan	
Problems	- Eliminate neighborhood school zone hazards - Aging fences urgent need for improvement - Walls and fences urban aesthetics	[23]
Community-based collaboration	Children from Seongbuk Elementary School participate In the design process	

Problem- solving	- Fence environment improvement
	  Create warm, beautiful walkways and safe routes to school to prevent crime
	  and reduce neighborhood anxiety	

Image source: G. Economy Today News, Yongdu Kim, reporter. Nov. 3, 2022(http://www.geconomy.co.kr/news/article.html?no=274867)

As shown in Table 4, this is a case of safety service design conducted by Noroo Paint. The company collaborated with students from Seongbuk Elementary School to improve the wall environment for safer school routes.

3.2. Institution

As shown in Table 5, this is a case of safety service design by the Busan Design Promotion Agency. Together with residents, local authorities, and school officials, a CPTED-based safe school route was created, incorporating lighting, safety facilities, and color planning.

Table 5. Design Council Busan safety service design

Classification	Analysis	
Coverage area	Yeonje-gu, Busan	
Problems	- Difficulty getting on and off school buses and walking - Unused land that creates anxiety	[19]
Community-based collaboration	Create a civic design team comprised of residents, jurisdictions, and school officials to develop the design	
Problem- solving	- Install sculptures and lighting on retaining walls to create a cheerful atmosphere - Color plan with children in mind and place safety features at a low eye level - Designing a color scheme that uses yellow to symbolize children's fun and laughter and blue to symbolize relaxation and consideration - Creating a safe school route by applying CPTED	

Image source: Design Council Busan homepage

3.3. Academic

As shown in Table 6, this is a case of safety service design by the Dongguk University Industry-Academic Cooperation Foundation. The foundation recruited the Goyang City Citizens' Solution Group, including local residents, to establish a model for children's traffic safety zones, incorporating universal design and safety facilities.

Table 6. Safety service design case of Dongguk University Industry-Academic Cooperation Center

Classification	Analysis	
Coverage area	Ilsan Elementary School child traffic safety zone	
Problems	- Difficulty getting on and off school buses and walking - Unused land that creates anxiety	[2]
Community-based collaboration	Recruited Goyang Citizens' Solution Team, gathered input from residents and parents, and conducted a study to analyze traffic conditions	
Problem- solving	- Establishing a model for improving child safety zones through ICT technology by utilizing industry-academia collaboration capabilities - Produced ICT-LED smart pans for speed reduction in Goyang City's child safety zone - Derived a prototype called 'Smart Childlike Innocence Road' - Utilized universal design to clearly distinguish between sidewalks and roadways - Created speed reduction facilities and a safe environment Established as a national child safety scale model	

Image source: Kim, M. S., A Study on the Design of Public Service for Children's Traffic Safety Smart City with Living Lab. A Journal of Brand Design Association of Korea, Vol.19, No.1, 2021. pp223-232.

3.4. Local government

As shown in Table 7, this is a case of safety service design by the Seoul Metropolitan Government. Seoul worked with school parents and experts to create safe school routes that address blind spots and alleviate concerns, including services for safe commuting and evacuation spaces.

Table 7. Seoul safety service design

Classification	Analysis	
Coverage area	Jangchung Elementary School, Chung-gu Elementary School, and Pil-dong Child Care Center in Jung-gu, Seoul	
Problems	Child safety insecurity/hazards in blind spots	[24]
Community-based collaboration	A total of 465 parents, residents, organizations, and professionals from all walks of life participated	
Problem- solving	- Creating a parent waiting area - Applying a calming design to slow down cars - Pavement with colorized patterns - Operate safe return home service and expand CCTV installation - Installing solar-powered raised pavement markers and high-brightness lighting - Designated a child safety guard house to provide a temporary evacuation space for children in emergencies - Established a safety management plan for Jung-gu and a resident life safety insurance program	

Image source: The Hangang Times, Yoon Jong-Cheol reporter. Jan. 6. 2022(https://www.hg-times.com/news/articleView.html?idxno=237102)

3.5. Summary of case analysis

We looked at examples of how corporation, institution, academia, and local government are creating safer routes to school. A summary of the case analysis is as follows: First, a collaborative system was established among members to achieve a common goal of solving the safety problem of children's school routes. Through a participatory approach, we identified areas where customized child safety public services can be developed to increase the effectiveness of policies. Second, consumers were actively involved in the process of policy formulation and implementation to improve their living environment. They examined various aspects of safety issues in the field, discovered problems, and promoted interaction. This has contributed to more realistic and effective solutions. Third, visualization played an important role in helping students understand the route to school and encouraging safe behavior. This allowed them to identify the various hazards and suggest more intuitive safety improvements.

4. Design Proposal for Enhancing Children's Safe Routes to School

In Chapter 3, we examined a variety of examples of community-based service designs that work together to achieve the goal of safe routes for children. In Chapter 4, we propose a community-based safety service design for improving the safety of children's routes to school. To do so, we designed a collaborative service involving local governments as service providers, relevant stakeholders, service designers, and residents. Jangseong-gun was selected as the workshop site because it was designated as a pilot area for Jeollanam-do's 2023 Problem-Solving Design Project. This initiative aimed to address local safety issues using service design methods.

4.1. Problem finding

As shown in Table 8, the issues derived from the workshop are summarized. A service design workshop to create a safe school route in front of Elementary School B in Jangseong-gun was held four times between August 28, 2023 and October 4, 2023. The venue was the meeting room of the Buk E-myeon Administrative Welfare Center, with 17 participants including residents of Jangseong-gun, service designers, design expressors, related experts, officials in charge of the project, and cooperating organizations.

Table 8. Problems

Priority	Problems	Photos
1	High risk of traffic accidents due to lack of separation between sidewalks and roadways on major school routes	
2	Increased risk when crossing the road due to lack of crosswalks	
3	Urgent need to improve sidewalk width on trails frequented by children	
4	Dark and poor environment under the highway	
5	Need to improve the roads and environment in front of the school	

In 2023, the Problem-Solving Design Project was implemented in response to the need for a policy to ensure the safety of children along the school route to B Elementary School in Jangseong-gun, and the National Design Team was formed. The planning of service design utilized the 4D (Discover-Define-Develop-Deliver) steps of the double diamond model developed by the UK's Design Council (2005). In four workshops, experts in each field, service designers, administrative agencies, and residents worked together to discover problems and design solutions. The design of safety service design to build safe streets aims to secure the safety of children and civilians, reduce crime, and increase life satisfaction.

It was found that there was a problem of securing identifiable walking space for nighttime traffic while scheduling safety accidents on the pedestrian path for children walking to and from school. It was necessary to secure the effective width of the sidewalk and improve the separation of the main sidewalk. In addition, there was a need to strengthen pedestrian safety at the entrance of the school and an urgent need to improve the dark and unpleasant environment.

4.2. Collaborative process and elicitation of needs

As shown in Table 9, the elements derived through collaborative cooperation in the service design process are presented. These include a summary of the practical and applicable elements and feedback.

Table 9. Collaborative deployment in the service design process

Priority	Suggested ideas	Majority or not
1	Painted pavements	○
2	Colorful pavement design	○
3	Safety fence installation	○
4	Installing elbow zone booths	×
5	Crosswalks	○
6	Solar street lighting	×
7	Improvement of the environment under piers	×
8	Installation of step lights under piers	×
9	Installation of CCTV under piers	×
10	Improvement of floor environment under piers	○
11	Pavement of side roads	○
12	Installation of steel grating safety barrier	○
Other opinions		

-Kids who walk long distances need pleasant school routes

-Apply highly visible colors and shapes

-Add cute graphics

-Safety fences are a must, so be sure to install them

-Consider the height of the fence and finalize it

- Wall improvements, step lights, and CCTV cannot be installed to comply with administrative requests

- Safety covers should be made of non-slip materials with low fall risk

- Proposed to install two crosswalks in front of the school

- Improvement of the entrance to the side roads by widening it

- Road lighting and pedestrian guidance lights are necessary

4.3. A service design proposal to solve the problem of children's safety on school routes

Table 10. Collaborative deployment in the service design process

Priority	Before	After
1		
2		
3		
4		

As shown in Table 10, this is the design outcome developed through collaborative cooperation in the actual service design process. Reflecting the opinions of the residents of Jangseong-gun, the safety service design was proposed in four categories. First, a crosswalk is installed in front of the school and a sidewalk is newly constructed to create a safe commuting route. The floor surface uses patterned colors to secure safety, and highly visible colors and shapes are used to reflect customer opinions.

Second, the side roads are painted and steel grating covers are installed. In response to customer feedback, the safety cover was installed as a cover that does not slip and reduces the risk of falling, and a striking color was selected to make it stand out. In addition, the coating pavement that neatly maintains the slopes improves the walking environment.

Third, environmental maintenance is centered on the floor in accordance with the prohibition of placing items under the bridge piers. In response to customer feedback, gravel is laid to separate the road from the passage, and solar street lights are installed for darkness at night.

Fourth, lane control rods and signposts are installed to separate the driveway from the road. Floor graphics are also added to the sidewalks to distinguish the sidewalk from the roadway.

5. Conclusion and recommendation

5.1. Conclusion

This study proposes a community-based safety service design to enhance school route safety, emphasizing the importance of community participation. Key points include: First, A participatory approach generates diverse ideas, identifies critical issues, and prioritizes key safety improvements. Second, Collaborative workshops build trust, clarify needs, and engage stakeholders like residents, parents, and authorities for sustainable solutions. Finally, User-centered service design effectively improves child traffic safety and fosters a safety culture within the community.

5.2. Recommendation

This study offers both academic and practical value. Academically, it contributes to traffic safety and service design research, highlighting community service design as cooperative governance. Practically, it identifies hazards through empirical data from workshops, proposing intuitive safety improvements. The study addresses school route safety by fostering collaboration among community members and stakeholders, generating

demand-driven ideas, and encouraging safety behaviors through visualization. By applying collaborative governance, it provides strategic directions for school safety policies. Presented at ISAAC 2024, this research includes literature review, case analysis, and detailed governance arrangements.

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