

A Case Study of Enhancing Ai-Integrated Physical and Arts Education Donation Programs Using the Sum Model

Eunsun Choi¹, Yujin Jung², Sunghee Kim², Hyunjung Lim², Hwayeon Oh², Youngmin Seo¹, Bokyung Kim³, Namje Park⁴

¹*Creative Education Center, Jeju National University, Jeju, Republic of Korea*

²*Institute of Convergence Science, Technology and Society, Jeju National University, Jeju, Republic of Korea*

³*Korea Foundation for the Advancement of Science and Creativity, Seoul, Republic of Korea*

⁴*Department of Computer Education, Teachers College, Jeju National University, Jeju, Republic of Korea*

In the revised curriculum in 2022 in south Korea, digital literacy was selected as a basic literacy to be cultivated throughout the entire subject. Accordingly, information technology including artificial intelligence (AI) is a field that should be dealt with together in various subject areas. In this paper, we developed the SUM model, a practical research model that can operate physical education donation programs that combine AI to contribute to fostering creative convergence talents living in the future AI era, and proposed ways to utilize it. The proposed model consists of three stages and is designed to operate a unique education donation program linking local resources. Based on this model, we present the results of developing and operating the programs. The educational programs were developed in 15 sessions, and it was conducted as an education that combines artificial intelligence in the fields of art and physical education. Traditional folk songs, museums, calligraphy education in the arts field, and snag golf, horse riding, windsurfing, and futsal education programs in the sports field were developed.

Keywords: AI-Integrated Education, Education Donation, Physical and Arts Education, SUM Model, Digital Literacy

1. Introduction

The development of artificial intelligence (AI) and digital technology has not only affected information curriculum education. The ability to understand and utilize AI, which has a profound impact on all industries, has also become crucial factors to consider in arts and sports curriculum education such as music, art, and physical education. In the revised curriculum in 2022, the Ministry of Education (South Korea) (2022) announced its plan to emphasize

language, mathematics, and digital literacy as new basic literacy beyond 3R (reading, writing, counting) and reflect it in the overall general and curriculum (Ministry of Education, 2022).

The purpose of the education donation project is to provide high-quality educational opportunities to students by utilizing the human and material resources held by society for educational activities from kindergarten to secondary school (Kim & Kim, 2021). Among them, physical education and arts education donations promote the expressive ability, imagination, and creativity of elementary and secondary school students through physical education and art education using human resources in the region. However, research on programs that directly contribute to convergence and complex capabilities compared to the AI era by incorporating information technology, including AI, into education in sports and arts education donation programs is rarely conducted.

Therefore, in this paper, we presented a practical model that can be the basis for operating an education program that combines AI with physical education and arts education donation and educational programs developed to utilize it.

2. Research Background

To change school education in the post-covid-19 era, it is necessary for students to participate in sports activities to develop their personality and improve school culture. Sports participation develops sportsmanship and sociality to experience positive emotions such as happiness and confidence, helps emotional stability, builds mutual trust, strengthens group affinity and communication capabilities, and provides opportunities to cultivate personality elements as community members. The Ministry of Education (South Korea) announced the Basic Plan for Revitalizing School Sports in 2022 and suggested the operation of school sports education, systematization and quality of school sports club operations, self-directed future sports talent development, teacher and sports leadership (Han et al., 2008). In particular, systematization and quality improvement of school sports club operation were promoted with the goal of promoting health and physical strength through physical activities. As detailed tasks, it is expanding to revitalize school sports club operation, expand face-to-face and face-to-face school sports club operation, and school sports club-public sports club operation.

Education donation refers to providing high-quality and diverse educational opportunities by directly utilizing the human and material resources held by society of companies, universities, and public institutions and providing them for non-profit educational activities. Education donations using base universities have a significant welfare, economic, and educational impact on communities that are less human and material than the metropolitan area, and are a network for effective educational welfare and survival and development of local universities. Furthermore, education donations in consideration of low-income families in rural and private areas can provide welfare and liberal arts education to the local community, while also creating beneficial effects on strengthening major capabilities and enhancing potential for educational contributors. (Kim & Kim, 2021). Kim et al. (2022) developed a school-regional cooperation model to revitalize physical education and arts education donations, which required professionals, college student clubs, and local sports facilities to revitalize school sports clubs and student art clubs (Kim et al., 2022). In addition, Lee and Lee(2018) proposed a software

education donation ecosystem model, which claimed that software education can help efficiently manage educational donations by efficiently matching schools and donors who need it. In this model, it was also emphasized that schools, government agencies, local governments, and IT-related companies should all cooperate together to efficiently carry out educational donations (Lee & Lee, 2018).

As we enter the era of the 4th industrial revolution, fostering convergence talent is becoming important. Existing interdisciplinary convergence perspectives are becoming essential and are spreading widely to social and artistic fields, and demand from industrial sites for global creative convergence talents is also increasing. Accordingly, educational programs in various academic fields applying AI are being developed. Zhang et al. (2022) proposed the AI Assisted Effective Art Teaching Framework, which aims for modern art education based on AI (Zhang et al., 2022; Min et al., 2024; Maltare et al., 2023; Kim and AlZubi, 2024). A study by Rusmiyanto et al. (2023) revealed that AI has the potential to significantly improve English learners' communication skills by providing personalized and interactive learning experiences (Rusmiyanto et al., 2023). In a study by Kim (2021), elementary school software convergence education was conducted by borrowing traditional Korean games, and students were able to improve computing thinking and have communication and creative problem-solving skills (Kim, 2021). As such, various researchers are studying ways to integrate AI and various subjects.

3. Research Methodology

In pursuit of developing an educational model for the operation of an AI-integrated physical education and arts donation program, this paper undertook a research methodology akin to that employed by Kim et al. (2022) in their educational donation model development. This methodology encompassed literature review, expert consultations, and on-site demand surveys.

The literature review revealed a diverse array of research and literature related to educational donations, with a predominant focus on topics such as the analysis of educational effectiveness, operational strategies, participant perception surveys, and case studies. Within the realm of physical education and arts donation, we analyzed literature related to expert advisory committee utilization and the development of school-community collaboration models as undertaken by Kim et al. (2022), along with case studies, exploration of participating teacher competencies, and policy advancement avenues (Kim et al., 2022; Lee & Lee, 2018; Stephenson & Bell, 2014; Francioni et al., 2021; Jung et al., 2020). In light of this, our research concentrated on referencing Kim et al.'s (2022) model development approach and findings, which were most closely aligned with the development of our physical education and arts donation model.

Furthermore, expert consultations comprised professionals in the fields of physical education, arts education, information education, and experienced operators of educational donation programs. Through their input and advisement, we developed the model, emphasizing its appropriateness and validity as an educational model.

In addition, the on-site demand survey focused on elementary and middle school students,

investigating the necessity of arts education through the utilization of cultural arts and scientific technologies. The results indicated a high level of necessity, with 84% of respondents indicating a need. Furthermore, preferences for program activities included "Appreciating Artworks Created by AI Robots" and "Creating Artworks using Smart Devices" (Korea National University of Education, 2018). Based on these results, we have developed various educational donation programs. Table 1 illustrates the research outcomes concerning the necessity of arts education via cultural arts and scientific technologies, categorized by school level.

Table 1: The necessity of art education through the utilization of culture, arts, and science and technology

Level	Necessary		Not Necessary		Total	
	Number	%	Number	%	Number	%
Elementary School	260	87.0	39	13.0	299	100.0
Middle School	149	74.1	52	25.9	201	100.0
High School	172	89.6	20	10.4	192	100.0
Total	581	84.0	111	16.0	692	100.0

4. Result and Discussion

In this study, we formulated the model for the integration of AI in physical and art education donation programs. The development process followed three distinct research methodologies, resulting in the creation of diverse educational donation programs that align with the established model.

4.1. Development of AI-Integrated Physical and Arts Education Donation Model

In this paper, the proposed operational model for an AI-integrated physical education and art education donation program consists of three major phases.

The first phase is STEP - Stepwise Foundation. In this phase, the objective is to cultivate a mindset of integrated talent within students through educational programs. Additionally, it aims to foster a comprehensive and integrated perspective on social issues.

The second phase is Unique - Local Specialization. In this stage, the utilization of the region's unique characteristics and human/material resources is crucial in designing educational programs. For instance, this could involve planning equine therapy programs considering geographical location and climate or designing and implementing Pansori (traditional Korean narrative singing) lessons with AI, guided by local Pansori inheritors.

The third phase is Macro - Operational Expansion. This model has been designed to transcend one-time occurrences of educational donation programs and considers the extension of research outcomes. It emphasizes tailored offerings to meet demand, strengthening promotion efforts, and assessing outcomes for the cultivation of integrated talents.

Through the practical research model composed of these three stages, we conduct research encompassing strategies for activating programs through the integration of local resources and ways to disseminate research outcomes, including the expansion of practical applications. Named as the SUM model, representing the initials of the three stages, Figure 1 illustrates the

proposed model in this study.

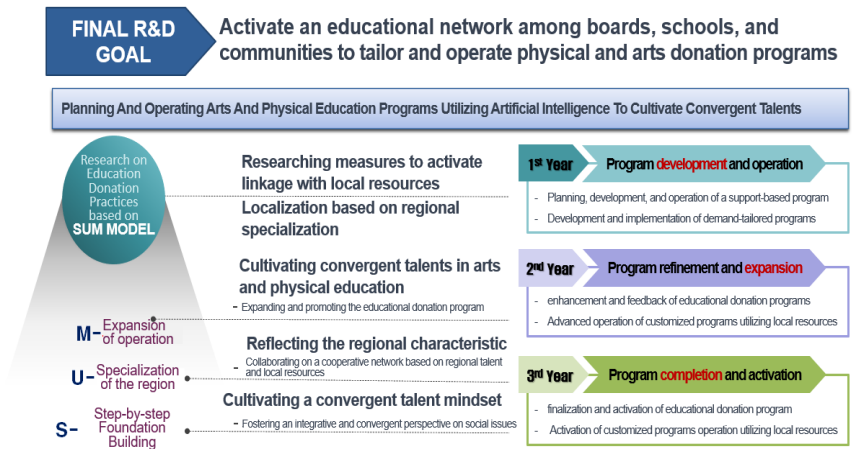


Fig. 1: SUM Model for AI-Integrated Physical and Arts Education Donation

4.2. Development of AI-Integrated Physical and Arts Education Donation Programs

Based on the practical research model proposed in this paper, the following three-year phased objectives and contents are suggested. In the first year, the goal is to plan, develop, and initiate the operation of an AI-integrated physical education and art education donation program utilizing local resources. In the second year, the aim is to enhance and expand the developed program. Particularly, this involves extending education to diverse target groups, supporting school sports clubs or art clubs, elevating programs targeting culturally marginalized individuals, and enhancing the completeness of after-school programs. In the third year, the objective is to refine and activate the developed program. It is crucial for the developed educational program to be firmly integrated into the field and sustain ongoing operations. Therefore, analyzing operational outcomes and promoting the program will be essential to ensure that a larger number of students can benefit from this educational program in the future.

In the recent development of the SUM MODEL, diverse educational donation programs have been meticulously designed. Each of these programs was facilitated via the benevolent contributions of lectures from professionals specialized in regional physical and arts education. Based on professional feedback and analysis, these sessions were methodically organized into a curriculum spanning 15 sessions.

Our preliminary initiative encompassed the development of support programs tailored for intra-school sports clubs and arts associations. School sports clubs, in the current educational landscape, are defined as extracurricular activities primarily focusing on sports or physical disciplines. While the South Korean Ministry of Education has been advocating for the amplification of such clubs, data suggests a notable decline in registration rates (Jin, 2018). A salient feature of our support programs encompasses an educational module on floorball—a sport rapidly gaining traction in physical education spheres. This module employs an innovative blended learning approach: leveraging Virtual Reality (VR) technology, participants are first exposed to online video lectures delineating game rules and warm-up exercises. Subsequent offline sessions are meticulously crafted to allow hands-on practice,

emphasizing various floorball techniques and postures. In the domain of arts, our attention was channeled towards the design and implementation of a program centered on 'Pansori'—an esteemed traditional Korean musical narrative. Recognizing the rich intangible cultural heritage intrinsic to our region, we endeavored to integrate high-caliber Pansori lectures into our curriculum. These sessions, harmoniously blending traditional and modern pedagogies, utilize digital platforms to enable an immersive Pansori experience. The curriculum encapsulates iconic pieces such as Chunhyangga, Sugungga, and Heungboga. Table 2 delineates the structure of programs designed to support school sports clubs and art societies.

Table 2: Education donation programs for school sports clubs and art societies

Class	Physical	Arts
1	Introduction to new sports and the importance of floorball	Introduction to pansori: theory and understanding
2	Pre-activity warm-up routines	Exploration of "danga" with a focus on "jungmori sacheolga"
3	Comprehending floorball and its rules	Exploration of "danga" with a focus on "jungmori sacheolga"
4	Basics of floorball stick handling (Using VR device)	Exploration of "danga" with a focus on "jungmori sacheolga"
5	Mastering floorball dribbles	Dive into "chunhyang-ga" with "sarangga" in "jungmori"
6	Dribble practice through training games	Dive into "chunhyang-ga" with "sarangga" in "jung-jungmori"
7	Introduction to floorball passing techniques	Unpacking "sugung-ga" with a focus on "a tiger is coming."
8	Perfecting floorball receiving	Unpacking "sugung-ga" with a focus on "a tiger is coming."
9	Diverse floorball shooting techniques (Practice game)	Unpacking "sugung-ga" with a focus on "a tiger is coming."
10	Advanced floorball passing and receiving (Practice game)	Exploration of "heungboga" through "bak taryeong" in "jinyangjo"
11	The stance and role of a floorball goalkeeper	Exploration of "heungboga" through "bak taryeong" in "jungmori"
12	Designing and implementing floorball defensive tactics	Exploration of "heungboga" through "bak taryeong" in "jung-jungmori"
13	Constructing and applying floorball offensive tactics	Exploration of "heungboga" through "bak taryeong" in "jung-jungmori"
14	Full-scale floorball match – I	Concluding with "chunhyang-ga: ibyulga" in "jungmori"
15	Full-scale floorball match – II	Concluding with "chunhyang-ga: ibyulga" in "jung-jungmori"

Subsequently, the focus was shifted towards designing programs targeting populations that are culturally marginalized. Within the realm of physical education, a therapeutic horseback riding program was envisioned, primarily catering to multicultural students. Therapeutic horseback riding, a regimen founded on the profound psychological bond between the rider and the horse, has been consistently acclaimed for its unparalleled mental healing properties. Given the unique demographic composition of the Jeolla Province and Jeju Island, where students from diverse national backgrounds are prevalent, this program was conceptualized. The program's pedagogy intertwines traditional and modern methodologies. Initially, students are introduced to the foundational theories of horseback riding through Virtual Reality (VR). Upon this

theoretical foundation, practical riding sessions are subsequently orchestrated. Significantly, there exists an opportunity to bolster the program's efficacy by integrating e-sports platforms. In the arts spectrum, a calligraphy training module was devised. This program leverages the expertise of a distinguished inaugural artist from the Calligraphy Association. The curriculum is structured to familiarize participants with the cultural heritage of the Jeolla Province. Moreover, students are encouraged to articulate their introspective reflections by crafting calligraphy pieces inspired by this rich cultural heritage. Table 3 outlines the configuration of education donation programs aimed at culturally marginalized students.

Table 3: Education donation programs for culturally marginalized students

Class	Physical	Arts
1	What is horse riding?	Orientation and basic stroke practice
2	General safety education	Basic strokes and consonants, vowels practice
3	Safety education needed for horse riding	Things around me
4	Basic horse riding theoretical education	Love and memories
5	Basic horse riding theoretical education (Using VR device)	Expression of earnest feelings
6	Learning how to mount and dismount	Cultural heritage of Iksan I
7	Learning the basic posture for walking I	Cultural heritage of Iksan II
8	Learning the basic posture for walking II	Hwaseonji dyeing
9	Matching the counteraction at a trot I	I can be a poet
10	Matching the counteraction at a trot II	Making coloring
11	Exercising at a canter I	Iksan's image hidden in the text
12	Exercising at a canter II	Message I want to convey
13	Healing horseback riding with nature I	Gifting you a fragrance
14	Healing horseback riding with nature II	Calligraphy application I
15	Let's Run Park experience	Calligraphy application II

Lastly, the initiative ventured into the realm of designing support programs for after-school student activities. On the athletic front, the research incorporated the SNAG (Starting New At Golf) program. This instructional golf paradigm, crafted upon years of seasoned experience and rigorous research by PGA tour professionals, harmoniously merges the benefits of miniature golf and traditional golf. Notably, this engaging variant places an intentional limitation on the maximum ball distance. One of the distinguishing attributes of this program is its adaptability, allowing for its operation in non-traditional golf settings like school grounds and gymnasiums. Pedagogically, this program leans heavily on artificial intelligence for a tailored learning experience, enhancing efficiency via AI-driven feedback mechanisms for the students. Preliminary and safety training modules are executed through VR interfaces, with AI systems meticulously gauging students' foundational knowledge. As a result, students are equipped with skills pertaining to pitching, launching, navigating a mini par-3 round, and absorbing the nuances of golf etiquette and regulations. Shifting to the arts domain, an experiential learning module was devised, centred on local museum visits. Students are given the unique opportunity to immerse themselves in both Eastern and Western art forms. This experiential immersion culminates in a reflective art activity where students, donning the hat of an artist, convey their interpretations through painting. This innovative initiative not only establishes a symbiotic bridge between smaller local museums and students requiring care but also holds pedagogical significance as an AI-integrated arts education. By intertwining AI, it furnishes students with a modern avenue to articulate their artistic expressions. Table 4

describes the composition of education donation programs tailored for students engaging in after-school activities.

Table 4: Education donation programs for students in after-school activities

Class	Physical	Arts
1	Preliminary education	Eastern Dancing Painter – Hong-do Kim
2	Safety education	Western Dancing Painter – Edgar Degas
3	What is SNAG?	Eastern Beauty – Yun-bok Shin
4	Understanding SNAG Rolling I, Chipping I	Western Beauty – Leonardo da Vinci
5	Pitching I, Launching I, Rolling II	Eastern Mischievous Boy – Uik-jin Jang
6	Rolling rounding, Chipping II	Western Mischievous Boy – Jean-Michel Basquiat
7	Rolling & Chipping rounding Pitching II	Eastern Blue – Ukiyo-e
8	Launching II, Golf etiquette, Par4 & Par5 rounding	Western Blue – Van Gogh
9	Rolling III, Rolling game, Chipping III	Eastern cow – Jung-seob Lee
10	Chipping game, Pitching III, Pitching game	Western cow - Picasso
11	Launching III, Launching game, Rolling / Chipping IV	Eastern Dream – Folk painting
12	Rolling / Chipping V, Short game, Pitching IV	Western Dream – Henri Rousseau
13	Launching IV, Pitching/Launching V-1	Eastern Indigo – Ilwolobongdo
14	Pitching/Launching V-2, Making Par3 SNAG Course	Western Gold – Gustav Klimt
15	Making Par4 and 5 SNAG Course	I am a Korean painter - Free topic

5. Conclusion and Future Work

Education donation represents a novel paradigm of societal contribution, connecting education providers, including corporations, public institutions, universities, organizations, associations, individuals, university students, and national agencies such as the Ministry of Education and the Korea Foundation for the Advancement of Science & Creativity, with education beneficiaries including students and educators, aiming to nurture students as creative and innovative talents and provide diverse opportunities (Yoon, 2016). In particular, physical education and art education donation programs play a significant role in establishing local arts, sports, and educational infrastructure. These programs offer teaching and talent contribution opportunities to university students, artists, athletes, and related businesses involved in education donation, while providing high-quality educational opportunities to students (Park, 2013).

In this paper, we emphasize the importance of AI-integrated physical education and art education donation programs in contributing to the cultivation of creative and innovative talents. Through literature review, expert consultations, and on-site demand surveys, we designed a practical research model for the operation of AI-integrated physical education and art education donation programs. Based on this model, we propose a three-year plan and content as utilization strategies to operate these programs for fostering integrated talents. In

addition to this, we have conceived various programs based on the SUM model. All programs are designed for 15 sessions, conceptualized to support school sports clubs and arts clubs, aid students who are culturally marginalized, and to cater to after-school students. Each theme presents programs divided into physical and arts categories, all of which are integrated with digital technologies, including AI. The significance of this paper lies in constructing a foundational model for educational donation programs that promotes a virtuous cycle through collaboration between domestic experts and students in need of quality education. However, the paper has limitations in that it does not provide empirical evidence or results regarding the effectiveness of students who actually participated in the education. Moreover, the validity of the educational program is not quantitatively presented. Consequently, future research is required to document the results and effectiveness of the conceived educational donation programs, necessitating both quantitative and qualitative results to be showcased.

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