International Journal of Advanced Culture Technology Vol.8 No.2 176-183 (2020)
DOI https://doi.org/10.17703/IJACT.2020.8.2.176

IJACT 20-6-22

Convergence Learning Program based on Childhood's Sociopsychological Development and Design Thinking

Kim, Sunyoung

[1]Prof., Dept. of Environmental Design, Incheon Catholic Univ., Korea
E-mail sykim@iccu.ac.kr

Abstract

This study inquired about the convergence learning program for childhood based on Erikson's play theory and design education for children's behavior development. I analyzed the convergence learning programs of Summer Camps in the Pacific Science Center, Galileo Learning. The contents of the programs show the most used imaginary and symbolic contents that represent the real-world problems which are related design thinking process. The curriculums and structure of the programs are based on the design thinking method and K-12 theory. The visual thinking method and the applications are used for expressing their creativity and approaching the technical skills easily. The play concept theory is an affirmative way to strengthen the children's psychological and social development. Therefore, the convergence learning program should integrate the design thinking process and apply the play concept theory for supporting and developing the children's behavior.

Keywords: *Convergence Learning Program, Design Thinking, Erikson's Developmental Frame Theory*

1. INTRODUCTION

1.1 Research Background and Purpose of the Study

Emphasis on the educational importance of the concept of play in the growth and development of children has become a powerful means of learning. Education for children can expect positive educational effects when reflecting on the growth and development stages of learners. This study analyzes the types and contents of convergence learning programs for children based on Ericsson's theory about play behaviors according to the developmental stages of childhood children. The purpose of this study is to analyze and examine the types of convergence learning programs for children with the design thinking process and Ericsson's concept of play in the psychosocial development of children. The goal is to examine the characteristics of the program for convergence education based on the concept of play and design thinking process for providing effective learning experiences supporting children's development. Based on the results of this study is to suggest the structure of children's convergence learning program and the direction of contents through the application of play concept and design thinking that reflects social and psychological characteristics. The scope of the study is to classify Ericson's theory of children's developmental stages from a social and psychological perspective and to analyze the case studies of the Pacific Science Center and Galileo Learning programs. The direction of

Manuscript received: April 10, 2020 / revised: April 29, 2020 / Accepted: May 05, 2020
Corresponding Author: sykim@iccu.ac.kr
Tel: +82-32-830-7104, Fax: +82-32-830-7072
Author's affiliation
Professor, Dept. of Environmental Design, Incheon Catholic Univ., Korea

the program contents development will be suggested through the correlation between the social-psychological development of the convergence education and the play type. Furthermore, I will consider the composition of the learning contents applying the concept of play as a method of convergence education to induce the stage of thinking required in the problem-solving process.

1.2 Research Method

This study examines the educational value of Ericson's social-psychological development and the concept of play through the analysis of theoretical literature and previous studies. Based on theoretical considerations, identify the characteristics of childhood and the value and type of play. Second, this study examines the necessity of the convergence program for children and examines the stage characteristics of the design thinking process. Third, the relationship between the stage of growth and play type of childhood children studied in the previous study was presented as the relationship between the stage of cognitive and social development, and as a framework for the case study. Fourth, through the case study of the programs, the learning content is analyzed based on the playable content of the convergence learning program for children. Fifth, the definition of the play type of childhood children as the center of the social-psychological development stage and suggest the direction of convergence learning program based on design thinking.

2. CHILDREN'S SOCIAL PSYCHOLOGICAL DEVELOPMENT AND PLAY CONCEPT

2.1 Play Concept for Children Education

According to previous studies, the play has a positive effect on the psychological and social development of children, and play is closely related to children's growth and development [1]. The main theme of Erikson's theory is human to play in which he argues that play is related to the formation of a child's personality and emphasizes the importance of play for the consciousness that is formed through childhood. Erickson argued that the concept of play supports the cognitive and social development of childhood children. Play can be meaningful in that it can satisfy the freedom of action and the individual's desires and do what they want to do at any time [2]. He defined the concept of play based on social psychological theory and insisted that play is instinct, learning, and meaning for children as meaning itself. It was emphasized that play behavior gives children the pleasure of the act itself and that seriousness and spontaneity are embedded in play behavior rather than purpose. He also said that children's immersion in play is the use of creativity to expand their world and form a mental model of their position. His theory categorizes play stages into self-world play, micro-world play, and macro-world play, and explains that play behavior through learning social skills and interacting with peers is played in the macro world. In terms of sociology, he regards the self as a relationship between society and the individual.

Table 1. Relationship between Play and Childhood Cognitive and Social Development

Cognitive Development Support in Childhood	Need an environment in which learners can form various group forms
	Need for a personal sphere that allows inquiry through creative thinking
Social development support in childhood	Support for solving problems that arise in social relationships
	Application of play type to form social homogeneity

The psychosocial development stages of children were classified into four stages, and the fourth stage of childhood is a crucial stage of self-growth. Theoretical considerations show that the concept of play is categorized into the aspects of children's cognitive development and social development. Plays that consider cognitive development include actual, functional play, symbolic and mimic play, passive play, constructive play, and rules. In other words, children can see that social development proceeds based on cognitive development [3]. Therefore, a variety of play and experience is a stimulus for supporting and growing children's cognitive and social development [4].

Table 2. Erickson's Stage of Development of Psychosocial Children

Stage 1	Basic Trust vs. Distrust	Ages 0-1	Trust building is closely linked to successful adaptation in all social relationships
Stage 2	Autonomy vs. Shame	Ages 1-3	The children want to choose between several conflicting urges and gain autonomy through this process
Stage 3	Initiative vs. Guilt	Ages 3-6	The basis for autonomy and independence is established according to one's demand Increased active Active physical and language use towards the outside world
Stage 4	Achievement vs. Inferiority	Ages 6-11	The critical period of self-growth Strong appetite for performance and desire for one's ability

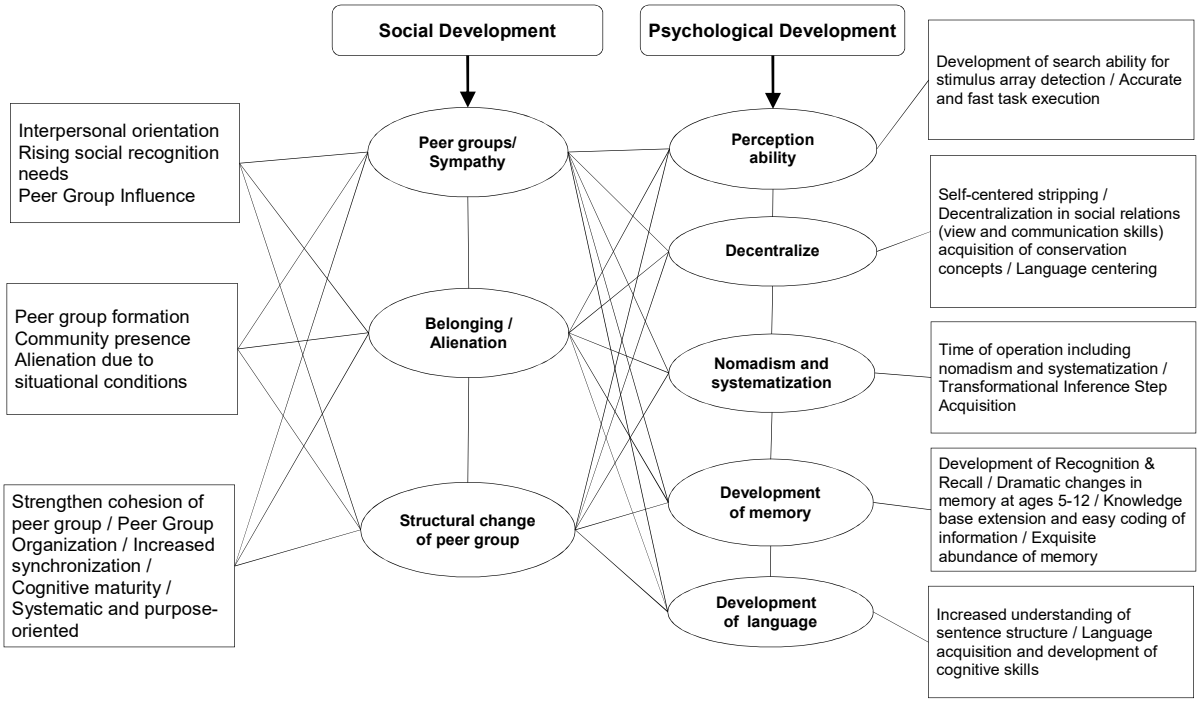

Figure 1. Relationship between Social and Psychological Development in Childhood

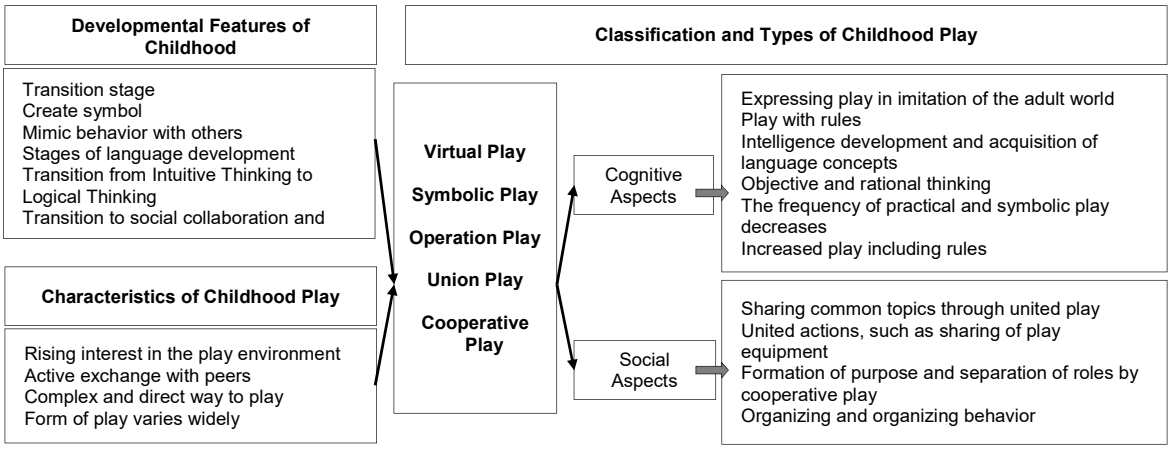

Figure 2. Developmental Features and Play Categories in Childhood

2.2 Features and Types of Play for Childhood

Plays in childhood include rules and competition as a form of play with rules of cognitive-developmental levels played in concrete manipulators and institutional, temporary, or arbitrary rules exist and reflect the external world and social rules. U.S. of America education law stipulates children as school-age children aged 6 to 11(stage 4) who must receive compulsory education in elementary school. This is the school year that cultivates the ability to use technically acquired perceptual and motor skills. This period is also known as peer period because it is a time to get out of the strong influence area of parents and become sensitive to an acknowledgment of peer relations and peers. Childhood is a decisive time for self-growth in Erickson's sociological growth stage, characterized by a desire to recognize performance and a strong desire to identify his or her abilities. The speed of developmental stage of physical, social, emotional, and intellectual as late childhood 6-11 years old is high and the importance of this stage is a step in the technical development of the already acquired perception and motor skills as well as physical development. With significant physical and mental changes, the childhood is the range of the social environment due to behavioral expansion of the range of activities also expands. In this period, children develop a multifaceted development through intensive learning in school and develop a personalized process and appropriate responses to the needs of adults due to the identification process of teachers and parents, stimulation and reinforcement by adults or peers. Gain control of behavior through in judging things, cognitive aspects develop, such as overcoming perceptual dependence and self-centeredness. The level of understanding of logical thinking and play rules can be improved, allowing for flexible negotiation and negotiation with others based on rules [5].

3. CONVERGENCE EDUCATION AND DESIGN THINKING

3.1 Design Education for Childhood

Design education in childhood is an early stage of design thinking, and it is intended to expand conceptual thinking and practical expression through play activities that allow systematic experience of basic formative principles. Papanek emphasized the need for the development of creative capacity and the ability to criticize cultural values and the necessity of early education of design in the elementary curriculum and the importance of learning the method and purpose of design [6]. For childhood, design education allows children to learn the structured development process of personal experiences and thoughts. Design education can be presented as a kind of play process that forms a mental image through the interactive discussion process for sharing ideas, the identification of objects, and the specific manipulation experience of materials for childhood children. Through these processes, design education contributes to the development of children's thinking ability. Therefore, the design education for children is to develop a learning method that provides learning process and learning environment centering on practical education and insight cultivation to observe and improve the surrounding environment in consideration of cognitive and social aspects of play need [7].

3.2 Convergence Education and Design Thinking

The areas of learning, cognition, organization, inquiry, judgment, manipulation, and cooperative type of behavior are closely related to the types of play of childhood discussed above, suggesting the possibility of applying play concepts in design education. In particular, the development of convergent educational contents combined with various linkage fields is required to induce an integrated approach and active participation of children. The goal of convergence education is education through firsthand experience and to experience the creative problem-solving process. The convergence education in the United States is based on STEAM(Science, Technology, Engineering, Art, Math) and the characteristics of the K-12 education program are the development of design-based education models and the spread of design education applying various program developments. The K-12 curriculum is based on the design of various activities linked with other subjects on an equal basis. The methodology of design education is characterized by the art of visual arts and an integrated approach with other disciplines and is to understand the elements and principles of design for the educational and creative problem-solving process through hands-on experience. The design process repeatedly utilizes divergent thinking that seeks alternatives to solve a given problem and convergent thinking that

transforms selected alternatives into reality. This process is the integration of intuitive thinking about problems that go beyond analytical thinking and logical associations. The design thinking proposes a methodology for creative problem solving through observation and empathy with human beings. It means seeking innovative results through the process of divergent thinking that understands human beings and seeks various alternatives to find the best solution for a given situation. Eventually, convergence education is the understanding of the use of materials, techniques, and processes, with knowledge about the structure, function, selection, and evaluation of thematic ideas and symbolic ranges in a creative way.

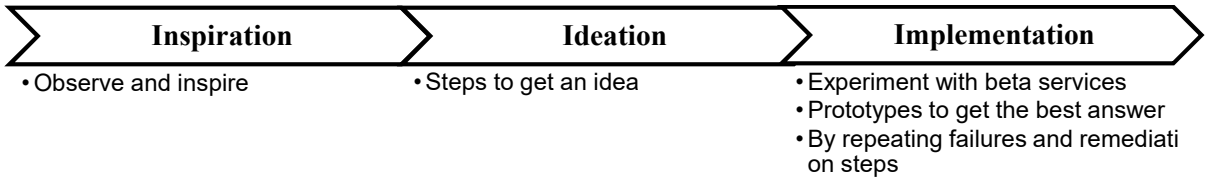

Figure 3. Design Thinking Process

4. CASE STUDY OF CONVERGENCE LEARNING PROGRAM

4.1 Pacific Science Center Summer Camps

The Pacific Science Center offers children the opportunity to explore, experiment, and ignite their curiosity through a range of innovative topics. The Camps for Curious Minds 2020 are offered throughout the year at multiple locations and the program topics are classified into nine categories in the Find Your Mind flowchart in Table 3 [8]. Every topic and the target ages are divided and have different activity processes and specific goals based on children's age and grade levels. The children work as a team to get active for a week of fun, games, and physics.

Table 3. The Camps for Curious Minds 2020 Topics

Topics	Themes
Artsy Mind	Experimentation with the full of colors, songs, and stories
Crafty Mind	Construction of buildings, robots, and all things mechanical
Experimental Mind	Testing hypotheses and the science behind living things
Fuzzy Mind	Imaginations of running with wolves, flying with birds, and playing with gorillas
Green Mind	Explore and dream of climbing mountains and wandering forests
High-Tech Mind	Thinking up the next big app and speaks in 1s and 0s
Hungry Mind	Seeking out the perfect crunch, sip, and chew
Medical Mind	Looking for the cure and wants to know how the human body works
Sporty Mind	Playing interesting games, sports, and competition

For 2–3 graders, Science Poetry Jam(Artsy Mind) is to navigate the stars, observe butterflies, touch sea urchins, and walk among the dinosaur in the exhibits inspire learners' poetry. Crazy Contraptions(Crafty Mind) is to engineer solutions to challenges using science by working together to build spaghetti towers, stick catapults, paper airplanes, foil boats, and a Rube Goldberg machine. Lab Wizards(Experimental Mind) let the children unlock the secrets of the world and discover the science behind real-life magic. In Eager Beavers(Fuzzy Mind) subject, the children explore what do beavers, biologists, and builders have in common as engineering. They observe through the wetlands in search of curious creatures, investigate the structures beavers use for shelter, and test different materials for creating habitats. Wild Waters(Green Mind) explore the creatures that inhabit aquatic ecosystems and the children visit local beaches to meet the critters who live and take a closer look at the salmon life cycle, build a watershed, and collect tiny aquatic organisms as they canoe Mercer Slough. Robot Rangers(High-Tech Mind) is to learn how scientists use robots to explore remote habitats from outer space to the ocean floor by skills to work using LEGO® and robotic parts to program a machine that can navigate obstacles and overcome challenges. Candyology(Hungry Mind) is to learn a new

recipe while exploring the chemistry behind sugary compounds of candy polymers. In Grossology(Medical Mind), the children investigate digestion, dirt, and decay as we dissect a squid, make milk spoil, and replicate the gastrointestinal process. Playground Physics(Sporty Mind) program tests the mechanisms that power the body to play kickball or frisbee while they examine the simple machines that make swings, slides, and seesaws. For grades 4–5, in Duct Tape Challenge(Crafty Mind), the children experiment the strength and durability of duct tape to creatively guide them as they construct their duct tape creation like a backpack, clothing, or chessboard. ChemLab, Inc.(Experimental Mind) offers the children become a researcher in a chemistry laboratory and join a team to conduct experiments to analyze reaction rates, create an instant cold pack, and extract the chemical components of toothpaste. In Crows: Caws and Effect(Fuzzy Mind), they study crow's anatomy to learn what gives them their unique ability to communicate, use tools, and adapt to survive with humans. Wild Survivor(Green Mind), the children build survival skills by identifying edible plants, finding safe drinking water, and splinting a broken arm. They master the use of a map, compass, track wild animals, and construct an emergency shelter on a camping trip. Bit by Bit(High-Tech Mind) is using Minecraft with Code Builder by exploring how block-based building with LEGO® bricks. Cooking Up Science(Hungry Mind) is to learn where food comes from, which options are healthier, and what makes things taste good by making a budget, buying the ingredients, and creating a meal using the science. Young Physicians(Medical Mind), the children get a head start on a career in medicine as they make a cast, perform dissections, extract DNA, and try their hand at suturing. Center Ring Science(Sporty Mind) offers the basics of circus arts such as juggle, walk a tightrope, and soar through the air on the flying trapeze by building their mental strength, flexibility, and understanding of physics. Road Trip: Sports is to explore the science behind sports. They take the 10,000-step challenge and try new fitness moves to learn how the body responds to exercise with teammates to discover what it takes to be an athletic champion. Science of Sailing to dive into the math and physics behind sailing by investigating the cause and effect of the wind in sails. They spend mornings modeling boats, conducting experiments, and the afternoons sailing.

4.2 Galileo Learning

Glenn Tripp, founder of Galileo, and Stanford's Dan Schwartz, professor at the Stanford Graduate School of Education and head of AAALab proposed a sophisticated curriculum for teaching innovative ideas in the research-project [9]. Each year, the summer camp program, titled create a world of fearless innovators, suggests a variety of topics that stimulate the curiosity of children's innovators. The Stanford team to develop a new fun, game-based assessment focused on testing the Galileo Innovation Approach using their game to see how camp affects kids from different socioeconomic statuses, developing a new version of the game to measure different traits, using the Galileo curriculum in other Stanford studies [10].

Table 4. The Galileo Innovation Approach®

Framework	Meaning
Mindset	A mindset that promotes innovative work
Knowledge	A process that supports bringing the best ideas to fruition
Process	Substantive knowledge that guides breakthrough thinking

The Galileo Olympic Games, National Parks Adventure, and Toy Makers Workshop programs suggest with age and grade-appropriate curriculum through a combination of art, science, engineering projects, outdoor activities, ceremonies, and play. Galileo Olympic Games project is to create mixed-media torches or t-shirts inspired by ancient Greek mythology. This project's goal is to celebrate the Olympic spirit with a range of winning outdoor games. National Parks Adventure is embarking on a wild journey into America's most spectacular spaces. The children make the collage the colors of the Grand Canyon or go face-to-face with their favorite park animal to investigate the mechanics of nature and adventure of a lifetime. Toy Makers Workshop embraces children's inner toymaker tinkering with playful projects. The children will take creative ideas out to play, redesigning classic toys and wire an electric spin-art spinner, or go full-tilt engineering an original pinball machine with illuminated back-glass with team challenges of outdoor games. The programs are structured by art, science, outdoor parts, and target ages are divided into preschool children(NEBULAS), Grades 1-2(STARS), and Grades 3-5(SUPERNOVAS). In Galileo Olympic Games, 1-2 graders make relief

sculpture with Olympic symbols, learn about physics fly of an archery bow and experiment with the Greece-inspired obstacle course in a field event. The 3-5 graders get knowledge of Greek mythology by experimenting linocutting techniques, mastering the mechanics of the atrial art to build the pneumatic system robot, and play team sports. In National Parks Adventure, 1-2 graders create an artistic puppet for Olympic National Park, learning structural engineering basics for building a bear-proof trashcan lid and work with the team to discover the animals of the park. For 3-5 graders, they search inspiration in the animals of Yellowstone to create a wearable wildlife mask, exploring ergonomics to build a PVC frame molded backpack by understanding stability and functionality. They also participate for outdoor trail with Yellowstone-inspired games. In Toy Makers Workshop, 1-2 graders learn paper-crafting techniques to construct a 3D vehicle with recycling materials, investigate the science of slides and slopes to build a spin art machine, and collaborate with teammates in Tossing toys game. 3-5 graders make the pinball machine with a visionary design for the back-glass on plexiglass, using machines to build a pinball machine by customizing targets, ramps, and design the rules. They also play a human marble maze with the fellows.

5. RESULTS

The topics and age-specific programs are for proceeding by increasing learning effects by providing scientific and artistic perspective formation, scientific principles, and play-type contents by children's cognitive and social development stages. Integrated learning structures support the cognitive and social development of childhood children through forms of organization, manipulation, and cooperative play that involve individual inquiry and judgment processes. Looking at the educational objectives and contents of each program, the Pacific Science Museum offers a variety of topics, including outdoor activity, artists and architects, creative convergence education. The structural features support the immersion process and activities for children's various interests and playful exploration. Galileo Learning provides playable content based on artistic visual formation and scientific principles. The theme of the program is age-based programs featuring Galileo Olympic Games, National Parks Adventure, Toy Makers Workshop, which provide a variety of perspectives and experiences on the history, nature, mechanism, and materials. The structure of the program is organized around artistic expression, understanding the principles of science and game activities. Both programs address the challenges of real-world problems centered in play-oriented education and the children to develop observing, design thinking, creative problem solving, and social relations. The children can be concentrated on respecting their curiosity, individuality, imagination in the importance of the physical education environment. The analysis of the relationship between the characteristics of the program and the type of childhood play, the examination of social and cognitive aspects of childhood play based on type and feature of play applying convergence learning program, and the social-psychological development are shown in Figure 4.

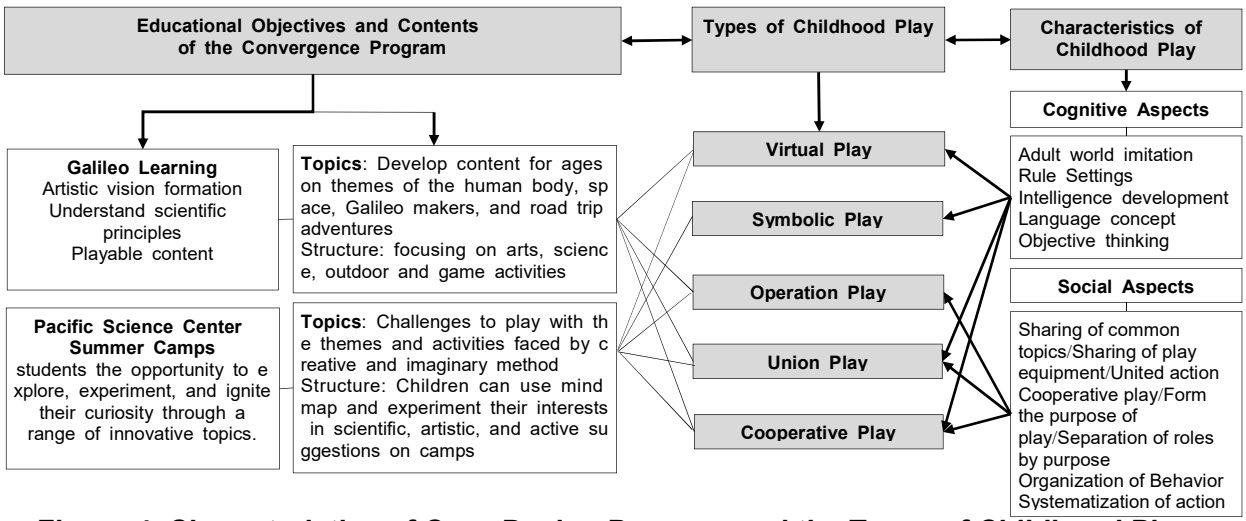

Figure 4. Characteristics of Case Design Program and the Types of Childhood Play

6. CONCLUSIONS

The convergence education content should support children's social and cognitive development based on the type and characteristics of play applying the psychosocial development stage of childhood. The childhood children experience psychological and social development through the play contents with the design thinking process in the form of virtual, symbolic, manipulation, association, and cooperative play. The contents of the convergence learning program reflect the psychosocial development stages of childhood for a given problem solving through play concept and design thinking processes. The children express the ideas through the most appropriate expression techniques, material selection, and experimentation that solve the problems associated with the subject and produce visual results. The positive effect of the play concept refers to the development of perception, decentralization, nomadism, systematization, memory, and language, which are the abilities associated with childhood psychological development. For the development of sociality in childhood, the educational value of play by experiencing social relations with others through play is important. It is necessary to provide a play type learning environment for forming social homogeneity and the learning process closely analyzes and derives the childhood children's cognitive level for visualizing, expressing emotions, and thoughts. For selecting contents for realistic problem solving, it should be suggested the subjects that children can relate to as contents for imaginary and symbolic play and the subjects should be analyzed by learners age groups to address the content. The play and the subjects are categorized by learner analysis of age groups to address the contents broken down by age group. For the structural features to be based on the design thinking process for convergence and linkage with the regular curriculum to find a solution to a given problem. Through play games, children learn expressions and order of production and present possibilities of expressions and it provides the sharing of ideas, physical activities, and forms of play appropriately for the design process and stages, and approaches in the form of collaboration and cooperative play. The convergence learning program for childhood children needs to support immersion and activities through various types of play based on design thinking process contents. It is important to support the cognitive and social development of childhood children by sharing interactions for effective outcomes. Also, it is necessary to consider the integrated curriculum for learning everyday play, to physically support children's behavior development and learning styles, and to provide physical environmental stimuli that meet the developmental scale of childhood children.

ACKNOWLEDGEMENT

This paper was supported by the Incheon Catholic University Research Grant of 2020.

REFERENCES

[1] Seung-hwan Yoon, "A Study on Designing Playgrounds based on Children's Play Behavior and Environm ental Psychology," Master's Thesis. Kookmin University, Graduate School of Design, Korea, p.18, 2008.
[2] Yongjin Cho and Do-hwan Kim, *Child Psychology*, Cheonglimsa, p.113, 1975.
[3] Kyung-Jin Oh, The Environmental Status of the Playgrounds located in the Apartment Housings' Area, M aster's Thesis. Yonsei University Graduate School of Engineering, Korea, pp.20-21, 2000.
[4] Bong-yeon Seo, Soon-Hyung Lee, Developmental Psychology, Jungangjeogseong Publishers, pp.271-424, 1 983.
[5] Sang-Shin Shin, "A Study on Outdoor Playground Applying Children's Play Characteristics," *The Journal of Korean Spatial Design Association*, Vol. 9, No. 1, p.106, 2014.
[6] Victor J. Papanek, *Design for the Real World: Human Ecology and Social Change*, Academy Chicago, C hicago, Ill., pp.45-98, 1985.
[7] Sunyoung Kim, "Design for Learning Environment based on Play Concept and Children's Behavior Devel opment," *The Journal of Society of Design Convergence*, Vol. 16, No.5, pp.57-75, 2017.
[8] https://www.pacificsciencecenter.org/
[9] https://aaalab.stanford.edu/index.html
[10] https://www.galileo-camps.com/