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Development of the A-STEAM Type Technological Models with Creative and Characteristic Contents for Infants Based on Smart Devices

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Abstract

Objectives: Smart software technologies such as social networking services and enhanced reality are rapidly evolving. This study is demonstrated to promote their creativity by expanding infants' thinking abilities through the development of the STEAM convergent educational model with Arts in the center utilizing smart devices. In addition, this model will serve as a basis for nurturing future learners. **Methods/Statistical Analysis**: A-STEAM contents model above the smart devices represents academic integration that centers on Arts and integrates science, technologies, engineering and mathematics to implement the convergence education. Here, Arts enables the convergent STEAM education by linking scholars, and also serves as a medium to enhance infants' creativity and character. Likewise, an open educational environment with smart devices enables the A-STEAM convergent education. **Findings**: Also moment of rapidly changing educational paradigms, the proposed A-STEAM type education based on smart devices will not only enable learner to earn mere knowledge but also enhance their integrated thinking ability embracing problem solving, creativity and character. And, the field of infant education, the proposed education will be an alternative education that effectively prepares the post human era. This study has a limitation that only develop an educational model. Therefore, based on the proposed model, the development, application and evaluation of relevant programs are imperative. **Improvements/Applications**: This model will be a basis for the development of teaching materials for the A-STEAM education.

Keywords: A-STEAM, Creativity Character, Infants, Smart Device, Technological of Models

1. Introduction

The human race is heading toward a post-human era beyond the 21st century's information era. Smart Infrastructures such as smart phones, tablet PCs, and smart TVs and their corresponding smart software technologies such as social networking services, virtual reality (tangible practice), and enhanced reality are rapidly evolving¹. Hence, education environments which employ those smart infrastructures and technologies are rapidly changing².

According to the report, "2020 Forecast: Creating the Future of Learning" by the Knowledge Works Foundation, the report shockingly predicts that traditional education

will vanish in 2020 because of drastic changes in the future economy and society. Therefore, specialized educations are imperative to convert a passive learner of technologies to an active consumer who proactively utilizes future technologies.

In current educational fields, a web-based educational environment enabled by the distribution of various smart devices such as computers with high-speed networks, has been well-established³. As multimedia has been dynamically employed in early childhood education and led to positive results, it implies that smart devices can be assimilated into the education as a part of multimedia. In spite of negative opinions in exposing infants to smart devices, the exposure has had rather positively effect in

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infants' enjoyment, focused attention, cooperation with others, and so forth⁴. Therefore, a proper use of smart devices shall provide infants with an effective educational medium.

As opposed to the general K-12 education that provides individual educational curriculum per subject in South Korea, the early childhood education has been implemented with national-level education curriculum that emphasizes the inclusive education as a major principle. Per se, it shows a significant similarity with STEAM that links Science, Technology, Engineering, Arts and Mathematics to enhance learner's professional knowledge, skills and creativity for their comprehensive thinking and attitude. As the early childhood education is aiming for constructivist education based on comprehensive, subject-focused, question-centered, investigation-oriented and practical learning, it is educationally aligned with STEAM⁵. However, limitations of the convergence education exist in the early childhood education. These limitations lack creative problem solving by utilizing technologies and engineering that are the main aims of the STEAM education, and have not been actively pursued in current early childhood educational settings⁶. Therefore, we propose to employ smart devices as educational medium, which collectively represent modern technologies and engineering, in order to implement the STEAM education. Thanks to unique features of early childhood education, vague differentiation between technologies and engineering and needs for educational dedication toward technology and engineering related activities exist. In order to overcome these limitations, smart devices that represent modern technological integration may facilitate proper and balanced interdisciplinary education by implementing the STEAM education.

A futuristic^z that a new society requires interdisciplinary people who are both "high concept" – creative and good with ideas, and "high touch" – joyful and good with relationship, not mere "knowledge workers". The STEAM education is ideal for educating those. In particular, the Arts section would enhance learner's emotion and creativity, and unify STEAM as a whole. However, as in a majority of current education, the Arts section mainly act as collateral activities that help the Science and Mathematics, active research and appropriate program development on the Arts are imperative.

Therefore, in this study, we aim to develop a creative and characteristic content model for infants based on 'self-directed, interest-motivating, and proper education as well as wealth of information', which are represented by the smart education via combination of both the contents of the STEAM education and smart education media.

1.1 Smart Device

1.1.1 The Concept of Smart Device

A smart device is defined as a device that is digitalized, enable constant connection to a network, and enable user's proactive expansion. It includes device concepts that embrace ubiquitous computing and artificial judgement⁹.

1.1.2 Definition of Educational Environment by Smart Device

The definition of educational environment established by smart devices is an on-line environment that provides various educational contents and services by expanding educational horizon¹⁰. In addition, numerous devices or objects are to be unified with computers and networks in order to provide an open educational environment that establishes relationship between infant-infant, infant-teacher, and teacher-teacher through communications and allows cooperative learning, in anytime and anywhere.

1.1.3 Various Forms of Smart Devices

Palo Alto Research Center¹¹ Incorporated proposes three forms of smart devices, which include the comprehensive concept of smart devices for ubiquitous computing. These are tabs, pads and boards as basic forms (Figure 1).

In Figure 1, three forms of Smart Devices: tabs, pads and boards.



Figure 1. Three forms of smart devices

1.2 The STEAM Education

1.2.1 STEAM Education Concept

The STEAM education¹² links science, technologies, engineering, arts and mathematics to enhance learners' professional knowledge and its application and to promote their creativity for interdisciplinary thinking and attitudes.

1.2.2 Importance of Arts in the STEAM Education

In order for the STEAM education to be successful as a consilience/convergence education, not as just mere integration, intuition and a metaphoric force from 'A (Arts)' that smoothly links one another among scholars¹³ are imperative. In order to develop creative science-engineering human resources who will lead the future society, educational curriculum must include contents and philosophies that promote artistic thinking, so that "Arts" plays a crucial role in the STEAM education¹⁴.

1.2.3 Creativity and Character

Creativity¹⁵ can be defined as 'the ability to create meaningful original idea, forms, methods, etc. from traditional ideas, rules and forms'. Character can be defined as 'the aggregate of features and traits that form the individual nature such as ways of thinking, attitudes and moral standards'. The combination of the two plays an important role in future human resource development. Factors of the creativity are fluency, elasticity, originality, sensitivity and activeness. Factors of the character include honesty, promise, forgiveness, willingness, decision-making, moral decision, yield and so forth¹⁶.

2. Proposed Work

In this study, we reviewed previous literature to conceptually define words and induce their components, and then we developed a model through its design, development, and evaluation for the A-STEAM type models with creative and characteristic contents for infants based on smart device.

2.1 Experimental Procedure

Step-by-step description of the experimental procedure in this study is demonstrated as in Figure 2.

Figure 2 shows a systemic process for developing an A-STEAM model with creative and characteristic contents for infants based on smart devices.

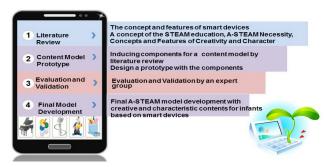


Figure 2. A systemic process for developing an A-STEAM model with creative and characteristic contents for infants based on smart devices

2.2 A Draft Design for a Content Model

In order to implement an A-STEAM prototype with creative and characteristic contents for infants based on smart devices, we referenced Kim *et.al.*'s STEAM integrated model analysis¹⁷ for the first draft as show in Figure 3.

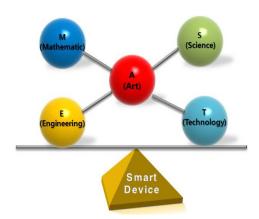


Figure 3. An A-STEAM prototype with creative and characteristic contents for infants based on smart devices

Figure 3 demonstrates an overall schematic that places smart devices as infrastructure, and the STEAM convergence model centering on Arts on top of the smart devices. The design of the model above the smart devices represents academic integration that centers on Arts and integrates science, technologies, engineering and mathematics to implement the convergence education. Here, Arts enables the convergent STEAM education by linking scholars, and also serves as a medium to enhance infants' creativity and character. A role of the smart devices shown

as infrastructure is to support and expand the A-STEAM type models with creative and characteristic contents for infants. Likewise, an open educational environment with smart devices enables the A-STEAM convergent education. Furthermore, interactions between infant-infant and infant-teacher will expand infants' thinking ability and promote their creativity, thereby endowing positive personal character.

2.3 Evaluation and Validation

In order to secure validity, our initial model was evaluated and validated by the following experts in the field.

First, a workshop was held on April 6, 2016 with regard to the subject –"A-STEAM model development based on smart devices" for faculty in the STEAM fields (4 professors specialized in education, engineering, mathematics, and arts, respectively) at Kyungsung University. We modified the multi-academic model of the STEAM, not with a model linked to Arts, but with a model integrated with Arts.

Second, a seminar was held for the STEAM education project team members (3 doctorates in Education and 2 doctoral candidates)in the infant creative/character laboratory with regard to the subject – "Development of the A-STEAM type models for creativity and character, and smart devices". The model fitness and smart device utilization was discussed and modified accordingly. Like this, we proposed our initial model to experts in the field, modified the model by accepting their opinions, and finalized the model.

2.4 Final Model Development

A-STEAM type model with creative and characteristic contents for infants based on smart devices in this study is shown in Figure 4.

Details of the model place smart devices (diversity, mutual relationship, scalability, linkage and so forth) as infrastructure, which support superstructure – the A-STEAM type convergent model. Arts that centers on the superstructure, enables interdisciplinary education by integrating science, technologies, mathematics, and engineering. Likewise, smart devices and the A-STEAM content model is an integrated accessible model for the infant STEAM education. This study will enhance infants' characteristic factors for consideration and respect by various and collaborative learning. We will also promote their creativity by expanding infants' thinking abilities

through the development of the STEAM convergent educational model with Arts in the center utilizing smart devices. In addition, this model will serve as a basis for nurturing future learners.

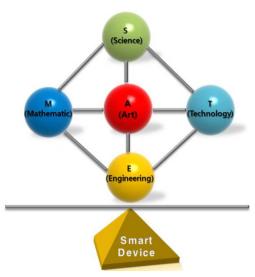


Figure 4. The final A-STEAM model with creative and characteristic contents for infants based on smart devices

3. Conclusion

Expected effects from this study can be demonstrated as follows:

- first, at the moment of rapidly changing educational paradigms, the proposed A-STEAM type education based
- on smart devices will not only enable learner to earn mere knowledge but also enhance their integrated thinking
- ability embracing problem solving, creativity and character. Second, in the field of infant education, the proposed education will be an alternative education that effectively prepares the post human era. This study has a limitation that only develop an educational model. Therefore, based on the proposed model, the development, application and evaluation of relevant programs are imperative.

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