Designing Education Contents for Chinese Character Utilizing Internet of Things (IoT)

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Abstract

Recently, the development of electronic teaching materials and the demand of digital learners have led the needs on the education contents that replace learning from character information and the change of an information design method for this. Chinese character education in the traditional schooling mainly focuses on writing and memorization (semantic memory). This way that the stories do not exist has brought the learners' recognition that Chinese character is difficult to learn.

Meanwhile, for a language study such as English, cross-media development between printed materials and audio-visual materials has been actively introduced. The method that extends episode memories along with memorization through a story is widely used. Therefore, this content suggests a prototype, which is broken away from an existing way of learning Chinese character that mainly focuses on writing, one sided instruction and information cramming. This makes learners learn through a story from printed materials and animation. Furthermore, it suggests a method that extends episode memories through Chinese education contents based on IoT explaining the principle of Chinese character by combining IT technology (information and communications, IoT) and education contents on block toys.

Keywords : Cross Media; IoT; Chinese character; Education; Contents

I. INTRODUCTION

1) Research Background and Purpose

As electronic teaching materials have been developed, a different approach from information design of the existing teaching materials is required. For the Chinese character education of current schooling, memorization is a primary method. However, memorization without a story makes learners easily forget what they learn and remember it only on the spots. On the other *hands*, cross-media development [1] between printed materials and audio-visual materials (broadcast and electronic materials) has been introduced for the learning of English, which extends not only memorization (semantic memory [2]) but also episode memories [3] by enjoying stories.

Marc Prensky [4] in "Digital Game-based Learning" stated the existing education method which mainly uses printed materials does not fit the current generation who grew up in the environment of digital media [5]. He also emphasized that the enjoyment of digital games hides the difficulty of learning and improves motivation. Even though there are many ways to present information, it is believed that this makes learners easily reflect their intellectual experience and stimulates the emotional aspect through animation with stories.

This study suggests a Chinese learning content with printed materials and video images to make learning

Chinese character enjoyable through pictures and stories by introducing cross-media to "Chinese Learning". This study also suggests a Chinese character learning content, which is based on edutainment Internet of Things (IoT) explaining the

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principle of Chinese character by combining individual Chinese character (total 2,135 characters) with cross-media and IoT. In other words, it is a Chinese learning content that uses intellectual blocks combining IT technology (information and communications, IoT) and learning contents on block toys.

Through an arrangement of blocks, it helps learners understand the principle and the basic structure of Chinese character.

The block toys that millions of children play with in the world are a verified product that develops children's creativity, thinking skills and space perceptivity. However, the existing block toys are a product that develops the right brain so; it has a limitation on developing the left brain.

The left brain can be developed through language learning and calculation. As the intellectual blocks based on IoT makes learners learn a language and calculation through block plays, it is the only learning tool to simultaneously develop both the left brain and right brain.

2) Study Scope and Method

First of all, after the hearing survey on Chinese learning methods, it was found that hieroglyphics that presents the related concepts of objects or the objects themselves by imitating the objects uses an episode memory for learning. However, a formation letter (Hsien-Sheng) and an ideograph are dependent upon a learning method by memorization.

However a formation letter only takes up about 3 % among all Chinese characters. Therefore, all Chinese characters (total 2,135characters) are classified as grandfather, father and offspring characters as a sort of Chinese character family tree system and as a material to explain the principle of Chinese character. Then, it produces a prototype and plans supportive materials through printed materials and video images. The final printed materials and representative animation are produced as cross media contents through the modification of hearing that targeted total 60 elementary and middle school students. The order is as the follows.

2-1. Teaching tips of Chinese character and textbook survey.

2-2. Precedence cases of educational content, data collection on etymology of Chinese character

2-3. Hearing survey on learning Chinese character (elementary, middle and high school students)

2-4. Writing printed materials, writing scenarios on textbook for video images

2-5. Making individual Chinese characters

2-6. Printed materials and video editing production

2-7. Hearing and correction

2-8. Suggestion on Chinese character learning contents based on IoT

II. Result of Production for Cross-media

The title of this content is "Cube Chinese Character" and the story is developed by splitting into 20 characters. The main target is teenagers who will learn Chinese character in the future but it also includes university students and adults who want to learn Chinese character for a cultural knowledge.

For the printed materials, an individual Chinese character family tree and pictures for video images are inserted. In the video images, it understands the principle of Chinese character by fitting the parts of individual characters (basic Chinese characters) like a cube. The reason why it used the cube method is that understanding parts of individual Chinese character is considered to be more helpful than individual Chinese character itself as Chinese character is made of a combination of parts of letters.

In the beginning of the body of printed materials, a family tree that is considered to be an individual Chinese character is presented and grandfather Chinese character is explained with images that used in video images. Furthermore, families of Chinese character are presented by using cubes by parts.

For the video materials, it explains the generation process of grandfather Chinese character and story develops by additionally showing animation regarding each part of families of Chinese character. For example, for 合 (assembling), the grandfather character "亼" is described by animation, which people gather from three different directions and then, a part "口" is shown as a lip through animation. It is a way to explain the meaning that people from three different directions come and talk to each other, which means assembling. In other words, it is intended to memorize the story by explaining the

origin of grandfather Chinese character, which is relatively hard to understand.

Fig. 1 Printed Material

Fig. 2 Video Material

After showing the contents to the target of 60 elementary and middle school students, 56 students said it is easy to understand. 60 students think that printing textbooks and video image materials are all necessary. Main comments and responses are as the follows.

– Printed materials : Some Chinese characters were found to be difficult to understand the etymology of the Chinese characters by means of only pictures.

– Video image : understood the generation principles of each Chinese character. Images are more familiar than printed books.

The minority pointed out a dryness of textbooks by saying that printed books seem like textbooks.

A few people mentioned that it would be better to have animation not only for a part but also for a final Chinese character, which is composed of parts and parts. After showing the prototype to two professionals of digital content production, some opinions were obtained; it seems possible to apply to electronic publishing, such as mobile terminals, and it will be better to have the links from a scene to a scene in order to know that parts are used in different Chinese characters.

Cross-media materials combined by printed materials and video images are expected to have synergy effects by reading and watching images in the learners' experience from "Cone of Experience" by Edgar Dale, which is used for audio-visual education. Even if it has an advantage that this can be easily provided as a textbook media, it is true to be remained as a passive experience. When using it in a real classroom in the future, it is desirable to review constructive directions that has a current story telling form and contains conversational factors such as "dramatized experiences" or "participation of discussion" by introducing various viewpoints via stories and animation. Furthermore, it was identified that the contents for Chinese character education using cross-media is not appropriate for preschoolers. It is required to develop the contents for preschoolers to learn through direct experience by sight, hearing and the sense of touch.

III. Cross-media and Education

1) Cross-media

Cross-media originally means news are produced and broadcasted to fit various media such as newspapers, magazines, TV broadcasting, internet and mobile phones. It is a newest term of a new report form to deliver information to receivers without boundaries of media. Through this report form, it is possible to change news to various

contents and receivers are able to deliver information regardless of time and place. Especially, when applying the cross-media form to advertising and marketing, it gives an opportunity of effective communications with customers by improving the message reaching rate to them. Through the repetitive and specific message, it can maximize the effects of advertising and contribute to the sale increase by stimulating customers.

The type of data that treats the color, space, the amount of texts (motion pictures etc.) of cross-media is necessary to be changed based on the characteristics of media. It is possible to construct a structure that improves the convenience of users when they are crossing media such as mobile phones while moving and computers at home. It is possible for a limitation of one media such as papers can be compensated by another media.

Technically, the content management system (CMS) is often used as there are differences of media factors/ output formats such as color, space, an amount of texts by media such as paper media (publication)/ computer/ mobile phones/ CD-ROM/ DVD. There are occasions that a system or a work is complicated.

In other words, cross-media can be confusedly understood from "a way to output one content data to various media for multi-purposes" to "a method to improve production efficiency by reusing one data." While one source multi-use is for the improvement of production efficiency, cross-media is for improvement of convenience of users to cross media.

Systematically, extending one source multi-use method to plural media is a general method of cross-media method.

More developed cross-media method is playing a bridge role of crossing media for users in the situation that one source multi-use method is used. It creates added value that a single media cannot do by using interactivity. There are the examples that looking at a map that was searched through a computer by using a mobile phone while moving or putting comments by moving to the certain page of mobile phone through a QR code to take a note after printing the searched map through a computer.

"Informing the top page of a website by printing a URL or QR code on advertising is cross-media that introduces another media, however, it is a basic step. The intention point of cross-media is improving convenience of users and pursuing added value by crossing contents pages rather than the top page with different media [5].

2) Cross-media and Education

Cross-media is mainly used in the press field such as report or advertising by now however it started to be actively introduced in the education field such as learning English through printed materials and audio-visual materials. It is widely used to extend not only memorization but also episode memories by learning through stories. Thus, this content suggests a prototype that is broken away from the current way of Chinese character learning focusing on writing, one sided instruction and information cramming and learns through stories from printed materials and animation.

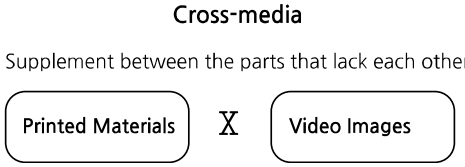

Fig 3. The Characteristics of Cross-Media Textbooks

IV. Proposal

1) Background of Proposal

Application fields of IoT are very extensive and expected to create massive profits. Google and Apple are pointed as the top company which leads IoT market hitting around two thousands trillions. However, this is the story limited to the Service-centric IoT which is similar to smart phone market nowadays from the perspective of CPND chain value leading contents, platform, network and mobile device. On the other hand, in Service-centric IoT market created newly, each character of CPND value chain is different to this of smart phone market. Therefore, Service-centric IOT market would be an open space where other various emerging company can appear except Google or Apple.

Like this, IoT is not only applied to safety, energy, construction, distribution and transportation but for safety of industrial accident, media, agriculture and stock breeding, national defense, medical treatment, finance and infrastructure or more other industry.

However, example of educational application has not been found. Therefore, Chinese character educational contents on the basis of IoT in the following paragraph.

First of all, Chinese character in common use can groups into three like grandfather letter, father letter and child letter. This is kind of system of Chinese character that explains principle of Chinese character. Furthermore, the script book, video and a prototype have been planned and created.

By editing the contents with60 students hearing, final script book and representative animation have been made into cross media contents.

However, after a hearing survey, the fact revealed that Chinese character (total 2,135 characters) contents by cross media do not proper for children. Even though currently script book for sure, electronic learning device, block and another type of learning tool exist, and much time and expenses would be consumed, learning ability of children is hard to be improved. The contents by cross media were in same case as well. That is because this learning process has been gone through without any consideration of age or character of each child. Since the children's living is sort of play, learning effect would be maximized naturally when education is done in the process of play.

2) Block Play

Children learn or are grown by playing and create themselves. Moreover, children play with particular objects, even can acquire by experiencing personally. For children, playing is to express their mind freely with medium of play. These free expressing activities motivate children's ego concept and spatial capability to be developed.

Bender insists that the block is for children specialized in fulfilling learning desire by playing. And with this, the block was supported as one of the play tool for developing overall abilities of children [7]. This is not able to give children a completed world but give an opportunity for them to think, have a conversation, create and even develop ego concept or spatial capacity.

Since long time ago, blocks having considered as an important playing tool and got many different shapes and purposes could be utilized as various playing tools. Plus, playing with blocks contains value, insight, principle pursued in the process in kindergarten. [8] When it comes to history or preference of children, it has placed in great part of children's education. Therefore, activities of playing with blocks enable children to satisfy, accept their own ability and develop the mathematical concept to control the objects. Also, it helps gaining the geological concept by letting them know the spatial concept. Like this, many researchers support the idea that block activities make easier way for children to grow, experience and play. Since they also said that it helps physically, mentally, socially and cognitively, it is definitely important information for children's education. In other words, by inspiring various concepts used in the process of children's education it helps children develop, [8] which is accepted in a positive way.

3) children's characteristics

3.1. cognitive development in the Pre-operational Stage

Piaget (Jean Piaget), one of renowned educational psychologist, established a comprehensive theory about cognitive development of human intelligence and adaptation. In Piaget's opinion, Cognitive development was a progressive reformation of mental processes caused from biological maturation and environmental experience.

Human can achieve phenomenal physical, social, emotional and intellectual growth within from born to early childhood. From birth to 2 years old, human can develop by depending on the others. However, after the period, human can achieve a remarkable growth and development in many areas such as walking, running, touching, holding, throwing, thinking, and learning in a largely independent manner. In the Cognitive development theory, Jean Piaget proposes four stages of cognitive development,: these are : sensorimotor, preoperational, concrete operational and formal operational period.

Piaget's second stage, the pre-operational stage starts at the age two and lasts up until the age of seven. During this pre-operational stage, children may show the following features.

Firstly, Ego-centrism in this stage results when a child cannot distinguish between their own view point and that of another person. Children are likely to stick to their own perspectives, rather than consider the view of others. They may not even understand that there could be another perspective which is different from theirs. Because they are not even aware that different viewpoints exists, they

assume that everybody will see the world in the same way as they do. Therefore children are very likely to have acquired knowledge which may be either true or false through this incomplete approach.

Concept of conservation means any amount of material, number, length, area, even if their form or positions are changed, they are identical as they were. Children in pre-operational stage have a difficulty to understood this concept.

Children in Preoperational stages are very likely to focus on the most significant stimulus in some circumstances and show a tendency to ignore other aspects that are less stimulating and they can't reason logically during this period.

Children typically grant lifelike qualities to inanimate objects and assume that everything in the world has life. This is called Animism. In the Animism, the infant consider throughout a variety of objects and reflect the consideration to their actions. For example, a child could believe that the sidewalk was mad and it had made them fall down.

Children don't clearly separate a dream from reality or separate imagination from reality. By thinking that everything exists in reality, they believe that the dream is in the bed or pillow. For instance, they could whine that they cannot find out in the reality what they had in their dream. The trait of realism is that they believe, their dream could be shown in the other's and that those dream exist in outside world.

Children in the Preoperational stage may find difficulties in comparing juice quantity when a cup of juice having the same quantity is spilled into a different cup. This is because it is impossible for them to have reversible mindset to understand that if the juice in the wide bowl is spilled back into the original cup, the juice quantity is just the same as it was previously. Children's thinking in the this stage can be limited by this irreversibility.

Children in the preoperational stage cannot understand that dogs can be included into the higher class of family. In other words, they cannot understand the concept of the category inclusion that various lower categories may also be included in the higher category. In addition, children reason illogically. They personify objects or animals and give an explanation of fact based on either art or fantasy.

In the cognitive development theory, Piaget explained how these perceptual and conceptual manners of thinking can be changed in accordance with children's physical growth. Piaget thinks that cognitive capabilities of children may be gradually acquired by interaction with their surrounding environment and that in general, cognitive ability can be developed in phase with this as they get older. Considering the above principles about the child development, the child's knowledge development should become adapted according to each development step and this becomes complex as children become more older.

3.1.1 From birth to 2 years of age

For children under 3 years old, the development of their five senses is achieved through a variety of stimulants. It is important for them to experience outdoor activities in which babies can touch and feel reality, and in the process acquire the ability to communicate smoothly with the world and grow into optimistic children who can love themselves as well as others. Therefore, playing with picture books and toys composed of various textures is helpful for their balanced development. Video watching which stimulates only the visual and audio senses is not helpful for overall balanced brain development.

3.1.2 From 3 to 4 years of age

In this period, children think in a unique and interesting way that all animals and objects are alive. They prefer a fantasy animation reality in which their likeable animals and objects are personified and depicted in reality. In this period, they cannot recognize reality because of this veiled imaginative world and it is good to show them a video which is based upon reality for developing their own sense of reality. Another characteristic which they display, is looking at the world via self-centered perspectives, and trying to confirm such identifications. Therefore let them become acquainted to reality naturally with other friends as well as themselves that they are living in this world by showing a simple animation depicting children playing altogether and watching friends of similar ages on the screen. In this period, being acquainted with the meaning of friends is the process for development. (fantasy character personalization)

3.1.3 From 5 to 6 years of age

In this period, children can gradually enjoy videos by understanding the audio & visual enjoyment and understanding complex stories. Children have a tendency to try to look for the movie or animation that they like, and equate their likable characters

with themselves in this time. Most of problems occurred to them are caused from their self-centered tendencies. They tend to possess self-centered tendencies and may inherit some problems from this. They can be stubborn and have a lack of the willingness to compromise with others, it helps to make them acquainted naturally as to why rules and orders should be kept (rules and orders).

Customized learning effects can be applied using board games in which virtual reality technology is used. The five senses of children from birth to 2 years of age can be stimulated through virtual reality and their various activities with this experience are possible because virtual reality can overcome the limitation of reality. For children from 3 to 4 years old, let them feel free to experience a fantasy world by personifying the animals and objects they like. For children from 5 to 6 years, their immersion in play can be maximized by getting away from simple audio & visual enjoyment and utilizing virtual reality in which a storytelling theme is added. The benefits of learning via play can be maximized by analyzing children's expected capabilities against age, and then acquiring data concerning that particular children's individual capability and engaging the child in the most appropriate manner. This data can be eternally kept and used for customized management of each child.

4) edutainment

4.1 the concept of edutainment

Multimedia education has the advantage that it can function in multiple ways by providing feedback to the child in addition to the experiences of seeing, hearing speaking and having a dialogue.

Edutainment is intended to be a learning method or study program which adds fun to a child's educational experience.

Edutainment is not a passive cramming process, it provides a more natural study method through which a learner's active participation is acquired by adding interesting and fun ingredient to the study. In Edutainment, study contents are developed in conjunction with specific learning objectives through a game form of program. Teachers should stimulate a learner's competitiveness and achievement motives by carefully presenting teaching objectives clearly in order for learners not to just display a limited interest.

4.2 The Characteristics of edutainment

The Characteristics of Edutainment are described as follows.

Firstly, the purpose of edutainment is learning. Therefore, the goal of Edutainment has to be educational in the end.

Secondly, there are game rules in Edutainment. Some game's rules are reflecting the real world, norms or social phenomenon, but most of them are comprised of artificial rules made up by virtual reality or imagination.

Thirdly, Edutainment has a competitive feature The competitor can be another party (Including computer), or themselves. Also the chance for challenge or the time allotted for the competition, but mostly it can be comprised of various aspects.

Fourthly, Edutainment can be challenging due to the objective being set-up. Challenging nature of this kind can provide learners with achievement motivation.

Fifthly, Edutainment is entertaining. Most games can stir up fun and interests. But, the fun in the Edutainment has to be used for inspiring study motivation and maximizing the learning effect.

By means of these traits, Edutainment can maximize both the effects of education and entertainment. Children can best learn having fun via entertainment not by a dull and strict teaching approach. In addition, children can engage in the learning activities for a longer time by having their interests stimulated.

4) Proposal for Developing the Contents of Chinese Character Education based on IoT

Proposal is the contents of Chinese character education on IoT basis which enables children to create images and to develop their brain [9] by direct experience with the sense of touch, sight and hearing. In other words, grafting IT technology and educational contents onto block tool is the proposal.

Therefore, intellectual block on IoT basis is convergence of conservative block which has been used as block toys and IT technology and educational contents.

① Listen and watch the Chinese character on screen of tablet or mobile.

② After watching it, blocking each elements of character.

③ After characters are completed; animation and sound with proper sound for OX are output on tablet or mobile.

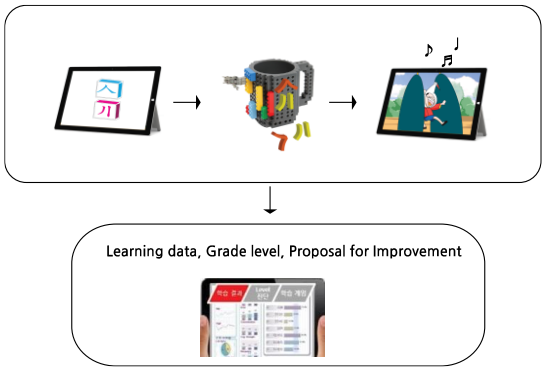

Fig 4. Intellectual Block on IoT Basis

Since intellectual block can be corrected by arrangement or combination of block, learners can memorize the Chinese characters in episode's process.

The Education Contents for Chinese Character proposed in this thesis indicate a learning content that children can learn Chinese character with spontaneous and positive attitudes. The education contents for Chinese characters may be changed according to learner's objects, purpose, ability and age. However, Chinese Character is not phonetic alphabet but ideogram containing a story. Therefore, the best way to learn them is by means of animations with a story.

It is already well know that animation can act as an excellent tool from the point of language education and acquisition. Students can learn Chinese characters naturally by watching an animation and they become interested with their elevated imagination rather than being bored in spite of a story being repetitive. In addition, it is valued effective because students can learn linguistic structure easily through storytelling in the animation. Animation could be utilized for a wide age range of educational situation from children to adults, all who can easily acquire the principles of Chinese characters because the contents can be fully understood regardless of academic or practical purpose.

This educational contents by using Internet of Things are categorized by observatory manipulation type, experimental type, study guidance type and problem solution type.

The most widely applied type is observatory manipulation and this type is a content of learning which includes storytelling method manufactured as a book form.

In the experimental type, students can participate in the operation of various activities, and students should be able to do complex operation activities in comparison with the observatory manipulation type.

In the study guidance type, students are provided with study contents when leaning space is moved. In this process, the technique to recognize leaner's locations should be used and it has a feature that learners need to carry with them the medium for the implementation of learning.

Finally, in the problem-solving type, the necessary information for carrying out the actual tasks can be provided to students by putting an emphasis on context understanding. This type is quite a complex learning system because learner's moving line and difficult operation activity should be considered.

The method proposed in this thesis is based on observatory and manipulation type.

The experimental type and the problem-solving type are very complicated for a leaner to operate and in the study guidance type a learner should carry a medium to realize augmented reality. Therefore, the observatory and manipulation type is applied in this thesis.

V. Prospect for Consideration

This study plans a prototype utilizing cross-media to develop education contents for Chinese character and suggests the development of education contents of Chinese character based on IoT for preschoolers. There has been a lack of utilization of IoT convergence business for education. It is identified that various approaches that are different from the existing IoT convergence business for education contents are needed. This study also implies a possibility of education contents utilizing IoT through a blueprint of education contents of Chinese character based on IoT for preschoolers.

However, some limitations were identified due to time and environmental factors. The greatest limitation on this study is that it only suggests a blueprint and has a deficiency in academic and technical approaches due to a lack of domestic and international advanced research even though this study is for developing education contents utilizing IoT.

However, as continuous research and

development on IoT convergence business has been progressed and the domestic and international markets of IoT rapidly grow, it is expected that further research would develop successful education contents utilizing IoT based on academic and technical advanced research.

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[1] Cross media: is forms for synergy effects by using a variety of medias such as radio, TV, mobile, and internet etc

[2] Episode memory: is the memory of autobiographical events that can be explicitly described. It is the collection of past personal experiences with image and emotion. This is emotional memory, not simple memorization. Therefore it is not easy to forget compared to semantic memory.

[3] Semantic memory: refers to the memory of meanings, understandings, and other concept-based knowledge, and underlies the conscious recollection of factual information and general knowledge about the world

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