Applying Digital Media Design in Elementary School – The Case Study with Soma Cube

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Abstract
SOMA cube is a block game that combines seven units of different shapes. With diverse assembly methods, these seven units can be created to unlimited shapes. Practice the SOMA which implies space record that may therefore enhance the learner's sense of space memories and creativities. This study is to explore all possible profit that can improve design education within matured digital medium tools. The research team prepared a learning program with media materials that help learners can easily understand the basic rules in SOMA cube. Combining digital media and SOMA cube as educational content, the current activities were based on elementary environment.
This research tried to applying the designing, planning and executing in school camp activities that would proof effective learning in theory. The ongoing findings are: these digital facilitated program can improve the learning, and the instruction with real cube practice increase the learner's motivation. The study outcomes also suggest that the learning activities with SOMA cube can be an alternative in design learning. The method using SOMA practice with digital tools may need to be further investigated.

Keywords: Design Education, Digital Media, SOMA Cube

Introduction

More and more convenient in our life with digital technology. We have more access to digital media. In the field of teaching, instructor's teaching methods and learner's learning way had changed due to digital technology. Applying digital media will enable learner more proactive in learning process (Jonassen et al., 2003). Although teaching equipment has improved, but digital media has not really integrated into the teaching. Most teachers only use digital technology as a teaching tool. Because of a new kind of technology is the best, and its application in teaching is wrong. We should pay attention to improving the quality of teaching content rather than increase the percentage of using technology (Beccue et al., 2001). Teacher has a number of devices, but they do not understand how to utilize these tools to improve and enhance current teaching methods. In this study, researcher use the concept of space as a starting point in elementary design education. Spatial ability include distance, level and other relations between objects. It can improve through training. SOMA cube can visualize space, groups of different shapes, train operator's sense of space (Thorleif, 2016). The researcher explore related literatures in three directions which include space capabilities, SOMA cube and digital media. Then plan implementation way based on literatures. The researchers used SOMA cube as teaching materials, the use of digital media support short-term camp teaching activities. Discussion how to use digital media into the design education. Efficient and scale to enhance the effectiveness of teaching and learners' learning outcomes.

Literature Review

In this study, SOMA blocks as an example, use of mature digital media tools designed to improve educational outcomes. First, the researchers will focus on the relationship between space capabilities in design education. Then explore SOMA blocks introduction, operation and spatial memory and so on. Finally, the researchers conducted analysis of the relevant literature about digital media applied to the design education. Summed up the principle of digital media used in design teaching process should pay attention to the content via the literature.

2.1 Sense of space and design education
Spatial ability is an ability about understand visuospatial information and solve spatial problems when operation in space activities (Rafi, 2005). Learners can enhance space capabilities through educational intervention. Observing objects from different angles can increase the ability of learner logical space. Therefore, instructors should be prepared various entities or models, provide learners depicting contact, compared shape and so on. These learning activities can enhance spatial ability learners (Cohen, 1983). Learners in the learning space design, the need to use the space as the heart of operational capability, spatial form of perception, memory, transformation, expression and so on. Designers can quickly exhibit space images in the mind and precise multi-level space as heart operations who has many years of space design experience.
But space designed for beginners, because space reasoning ability and experience are limited, and they do not develop the use of external operations make up the space like heart operation. These may lead to the design schedule delays. Linn and Petersen (1985) believes space capabilities can be divided into spatial perception, mental rotation and spatial visualization three parts.

Spatial Perception is the use of visual-spatial ability to describe the spatial relationship. Mental Rotation refers to the ability to mind the image of the imagination. It can use two-dimensional plane message to construct a three-dimensional modeling. Construction process with limited spatial visual imagery plane message (Huang & Shyi, 1994). Spatial Visualization is the ability of continuous complex folding and moving images of the operation. Spatial recognition ability of poor people may be using different memory and the ability to convert spatial location.

2.2SOMA Cube

The building blocks filled with childhood memories of many people, through a combination of stacked, users can create a variety of shapes. There are many types of building blocks, shape and function, each with a different play, but also to train users of different abilities. Building blocks types include plastic building blocks, wooden building blocks, paper building blocks, etc. When early childhood development, building blocks can cause the most interest and suitable in children's toys.

Children playing with building blocks have helped for body movements, language ability, cognitive ability, social skills, creative ability and other ability development. Building blocks the application object and pertinent literature containing the children toys, child care aids, elementary mathematical, architectural concepts and knowledge system, mathematical concepts and knowledge systems, etc. Blocks can help cultivate the capacity necessary for the design of teaching and its application in a number of design-related field study, students can enhance learning motivation. Space imagination is not only and mathematical ability, but also with closely related creative thinking, physics, chemistry ... and so on. Training learners left brain through games, making them more understanding of three-dimensional space. Many game elements will be assembled to fight through the composition of three-dimensional graphics, SOMA cube can be seen as a three-dimensional jigsaw puzzle assembled game. SOMA blocks invented by Piet Hein in the physical speech. Each composed of SOMA cube rule is within four cubes of the same size formed in contact, these elements can be composed of a large positive cube. These elements have 240 kinds of ways to assemble into cubes (Thorleif, 2016). To form unit cube of the number of building blocks to distinguish, it can be divided into three building blocks and four building blocks. In addition to the composition of the number of units, but also to the flat space and three-dimensional space, building blocks appearance distinction.
Block 1: Only one consists of three small cubes, belonging graphic, as shown below.
Block 2: Block 1 plus a cube in a row on one side of the cube, as shown below.
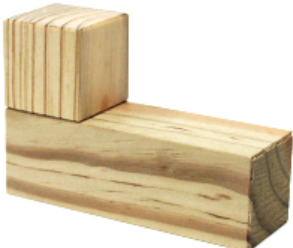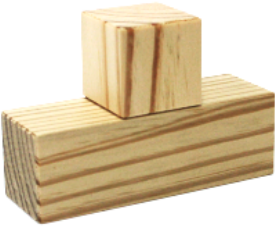Block 3: Block 1 plus a cube in a middle of row, as shown below, as shown below.
Block 4: Appearance similar to the Arabic numerals 4, as shown below.
Block 5: The result of block 6 mirror projection. Appearance similar to left thumb up, as shown below.
Block 6: The result of block 5 mirror projection. Appearance similar to right thumb up, as shown below.
Block 7: The fourth cube blocks placed in the corner of the flat block 1, three-dimensional symmetry, as shown below.

Table 1: SOMA cube element.

Block 1	Block 2	Block 3
Block 4	Block 5	Block 6
	Block 7	

SOMA cube can spell 3 * 3 * 3, but also can spell a lot of shapes. But it is difficult to understand its composition manner, only through the images to identify modeling. In order to facilitate the recording and memory SOMA three-dimensional modeling, will shape the international level as a unit to separate records for the number sign code building blocks, a blank portion of black dots represent, empty the write position 0. If the shape of a combination of two blocks from Soma, the second SOMA respectively V, L, T, Z, A, B, P as a number. For example, the figure below the uppermost layer, respectively by the block 1, block 3, block 4 and block 5 composition, in accordance with the position corresponding to the record results are as follows. Other layers and so on, and so other ways shape the record mode and relative hierarchical position record.

Table 2: Blocks recording.

	Layer 1	Layer 2	Layer 3
	411	657	677
	415	455	667
	333	432	222

2.3Digital Media applied to the design education.

With the development of science and technology, digital technology is changing rapidly, there are many contacts digital technology opportunities and occasions, whether it is the spread of advertising, film, school teaching and other ubiquitous digital makes life more convenient, all media content is generated through the selection and construction (Potter, 2005). Digital media is changing the design practice and teaching, the new digital technology to break through the limitations of traditional design tools, providing designers a variety of authoring tools, designers stimulate creativity, enhance the performance of learners in the process of operation. Social expect teachers to use advanced digital media on student learning activities, the actual teaching situation is not as good as expected, the proper use of digital technology in the teaching field domain becomes a problem instructor when engaged in related teaching to face (Freedman, 2000). Hemmerla (2000) for the 300 art teachers in Missouri's questionnaire found that arts teachers think digital technology in teaching methods with a variety of changes, the use of digital technology assisted art teaching can have great success, the course combined with digital technology can not trends in resistance, the majority of those who support teaching in a professional arts organizations and institutions, which promote the strengthening of action and use of digital technology training. In order to design the development of modern education, teaching by using digital technology aided design education, but before performing, teaching those who need to understand the characteristics of digital media, in order to effectively apply it to teaching. Currently teaching elementary school who, since teaching preparation time is short, information literacy varies, rarely in the digital content into actual teaching in the Field. Teaching will be a new element into the courses, if forced to combine, learners may have doubts. Heinich et al (2002) believe that a student can improve the effectiveness of teaching learning media, it must have four qualities:

1. Multiple textbook presents the message: Elements of teaching activities is to be able to present information

2. Stimulate students to participate: the learning process requires students to actively participate

3. To promote teacher-student interaction mechanisms: interaction between students and teachers, and peers, are able to enhance the effectiveness of learning design

4. To provide rich learning resources: teaching content, provides students with supplementary teaching materials and reference materials to increase the breadth of learning learners.

Levin, Anglin & Carney (1978) considered the following five digital media educational function:

A decorative content (Decoration): attract the attention of learners and improve their learning enthusiasm

2. Provide characterization (Representation): in favor of messages received

3. Conversion knowledge (Transformation): changing patterns of knowledge, so that learners construct new branches

4. Organize messages (Organization): The teaching content to make a systematic organization and presentation

5. The interpretation of meaning (Interpretation): to explain the contents of text information

In addition, educators planning digital media auxiliary teaching, allowing students to actively participate in learning activities and repeated practice, enhance their memory

and ability to apply knowledge, new skills and different learners have different learning ability, teaching should be given for learning activities, teaching those given timely feedback that enables learners to understand their way of thinking is correct, and combine human interaction in the teaching process, people get along with each other at any time can become a mentor or spiritual companion study, reflecting the teaching and learning of (Heinich et al., 2002).

Method

In this paper, the use of digital media assist teaching activities. Providing students teaching activities about SOMA cube, so that students have an alternative learning experience. Teaching activities about SOMA cube held in October 2015, participants comprising research team, and 40 elementary school students.

The researchers determined the direction of research, the collection and analysis of relevant literature in order to develop the teaching content and steps. Finally, the use of digital media tools to plan teaching materials so that students achieve effective learning. According to the literature review and analysis, the research team must have the ability to produce teaching materials when digital media integrated into the design of education. Considering the instructor teaching process, use of mature computer equipment and technology when digital content assist educators in teaching activities. These enable learners to achieve the best results and teaching process more smoothly. Visiting Xin-Sheng elementary schools, conduct field surveys to understand the characteristics of learners and degree of ability. The researchers communicate with the school teaching based on learner characteristics and field resources. Adjust teaching content in order to be able to produce in line with the content of the learning object. According to the characteristics of learners, teaching environmental resources, teacher capability and expertise to plan, implement digital media auxiliary teaching activities SOMA blocks of content and process. Researchers discuss the content of teaching materials should contain and teaching presentation with experts. At the same time, the research team carried out a detailed design and planning from different directions, personnel, equipment, teaching methods, processes, activities and so on. After complete design and planning about digital media material and activities, the research team carried out small-scale simulation tests. For there may be problems, amend or propose solutions to solve it. In the implementation phase, the researchers involved in teaching activities, to observe and record the behavior problems in process, and conduct a review after the event ends. In experience sharing and reviewing the issue stage, researchers planning activities about participates, learners, teacher to share their experience. Then organize and classify data about content experience, observation, etc. Researchers investigate the phenomenon and problem in activity, and proposed findings and suggestions in the end.
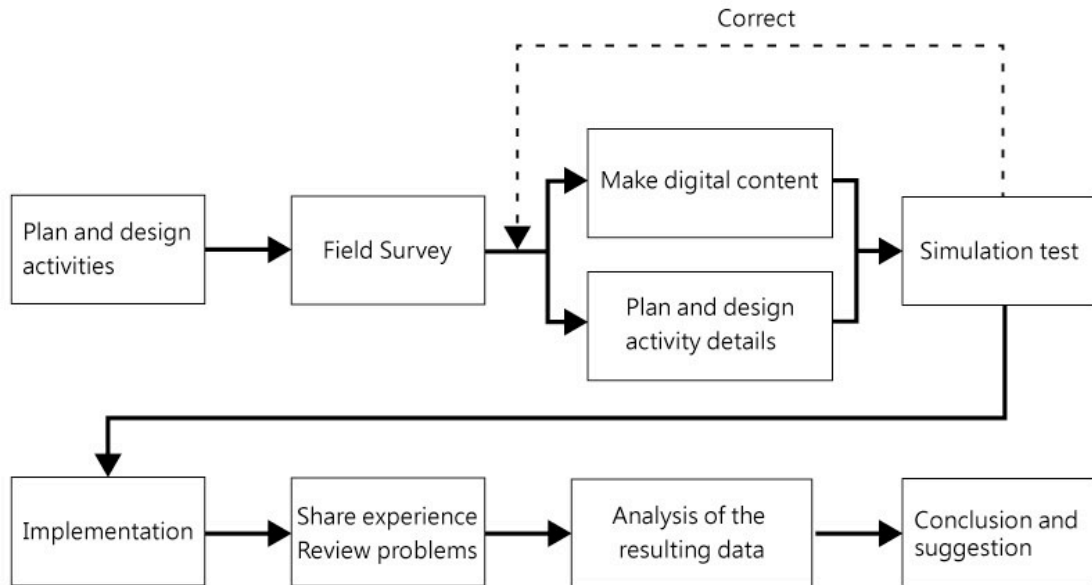
Figure 1: Research Process.

Results

4.1 Course material design

Textbooks to digital media tools production, digital content and form secondary Instructor in the Field of Education, and experts and the school to discuss the revised, the teaching materials comprising: a guide film, SOMA history, understanding SOMA element, to piece together the positive cubes, fight group SOMA modeling and SOMA blocks related applications. Guide the use of video modeling paradigm making short films, learning atmosphere, so that students quickly into the learning environment, students recognize SOMA history to lead the building blocks of its history, recognize SOMA element modeling before children start to fight the group, being able to distinguish the SOMA cube consisting of each a member, let children observe blocks, each element consists of a few cubes, are several times modeling space, through its different characteristics corresponding to said given number, then led the students to use this seven basic component assembly modeling positive cube of SOMA preliminary after understanding, we can begin to take advantage of the seven member assembly faces different shapes, and even assemble their own special space modeling in the final presentation SOMA blocks related applications as the end.

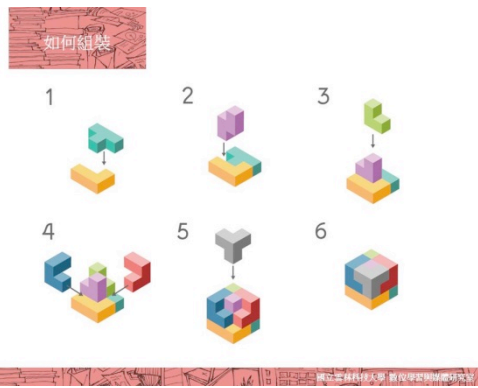Figure 2: Teaching materials - SOMA element.

Figure 3: Teaching materials – SOMA assembly.

Figure 4: Teaching materials - SOMA modeling.

4.2 Design and planning activities

Design and planning activities mainly in the planning process and the overall activities of activities, this event in addition to digital media auxiliary teaching activities, but also in the teaching process related design planning activities, such as school children, led by the co-authoring modeling Instructor, or by the flip, mirror and other topics so that students creation, increase students participation, training students the ability to think for themselves. In order to guide the overall process sequence videos, performances bricks, blocks SOMA understanding, understanding SOMA element, to piece together the positive cube, special assembly modeling, spatial memory and recording method, co-creator, avatar creation, this stage is also designed to develop a series of visual beauty Vision, to create a complete learning atmosphere.

4.3 Simulation activities

The researchers conducted a small-scale simulation test, after the course materials design and complete design and planning activities. Observing different aspects and asking questions about processes, digital textbooks, teaching and learners. All of the process from the front to the end of the event, contains pre-equipment and personnel. We must check for what equipment and work missing or not. Digital media instruction test focuses on whether instructor can use smoothly. Instructor and learners need to pay attention to issues contained Instructor teaching process is smooth, whether the content is clearly expressed.

By the learners' questions or conditions that may exist of the learner, found through repeated drills planning deletion, correction adjustment activities and materials, and finally found the problem and the difficulties amended to ensure the implementation of activities that day can proceed smoothly.

4.4 Actual execution

After simulation testing phase is completed, the researcher actually perform on the field. The researcher simulates the actual situation. When we encounter problems, we handles and records immediately. The instructor introduce themselves and describe the theme of today's event after teaching environment layout is completed. Playing digital media content to create a learning atmosphere and guide learners into the learning environment. Students understand SOMA cube and constituent elements by instructor and digital media instruction. In the implementation phase, the instructor teaching, also arranged assistants to assist instructor. When children have problems, assistants provide immediate assistance to solve the problem. The research team designed a series of activities to provide students stage. Children can operate SOMA cube, self-exploration, understand of modeling applications, and experience digital media materials. In co-authoring phase, students become creators of works one and share their creative works with others. In addition to viewing teaching activities and learning outcomes, but also increase the confidence of students. After teaching activities, issued participation certificates and appreciation. A group photo of all will draw a perfect ending for teaching activities.

Conclusion

The researcher collected the raw data which including photos, videos, instructor experience, learner experience, and so on from the entire activity process. Sorting and analyzing the raw data to generalize the problem and phenomenon about designing and executing digital media into design education activities. Depending on the nature categorize the questions contain digital media teaching materials, activities, processes, Instructor and learners. The following will summarize conclusions:

Digital media instruction:
Producing digital media instruction will require a lot cost, including manpower, content, technology, etc. The cost which use in produced digital media instruction is too high, if design educational activities is a one-time activity. Digital media is capable of attracting the attention of the learner when instructor teaching process. Not only allow instructors to master the scene, but also improve learners enthusiasm. The researchers recommend that may bring mature digital content into different schools in future, so that resources can be sent back to their maximum efficiency.

Activity flow:
Because SOMA cube contains seven elements, it causes a chaotic scene when giving building blocks. In this situation, there may be no thought in advance comprehensive. All of situations in activities can be used as future reference. Co-authoring and personal creative which research team prepared can help learners not only follow the textbook learning, but also provide an opportunity to exhibit self-thoughts.

Instructor:
Instructor expressive is clear or not. Instructor can guide students logically or not. Both of them will affect the teaching activities and can improve by repeated practice in advance. Children may ask questions which instructor unexpected at any time. It will test the resilience of Instructor. In addition, there are teaching assistants assisted. If teaching assistants have no prior knowledge about teaching content. Teaching

assistants who provide material assistance is limited, there may even be a problem of the teaching process.

Learners:
Learner's spatial ability are different. In the teaching process, the researchers found that some learner space operation capability is weak. It may lead to delays in teaching time. It can maintain learner's enthusiasm and motivation by assist them or encourage their performance.

In the past, the design education teacher in the elementary school just teach children a specific theme. For example, drawing, pottery, painting, etc. Educators rarely combine different media or material for learners. The researchers combined the digital media with design education, and organize short camp teams to be verified.
Interspersed with different activities in the teaching activities, so that the original content activation. In this discussion, it can be expected for future reference related research or activities.

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