

A Digital Batik Tool

Supporting children in understanding and constructing traditional batik patterns within a museum context

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Abstract—Batik is a method of drawing using *canting* and *cap* to create intricate designs on textiles, generally cotton, dyeing it whereas patterned areas are covered with wax so that they will not receive color. In a deeper meaning, batik is not only the pattern on clothes, but it is more about technique and process.

In Indonesia, the technique is an ancient method, which has been practiced since prehistoric times. Nowadays the technique has been improved but still left some constraints during the process and consumes a lot of time. This phenomenon causes that young people and young children are not really keen in learning how to make batik using the traditional technique, even though they love to wear batik clothes. Some batik museums in Indonesia provide huge collections and conduct regular workshop of making batik. However, the lack of opportunity to teach and transfer the skills of making batik is still problematic.

This paper shares the preliminary concept of a digital tool designed to support young children in learning to make batik patterns by themselves. The software is supposed to be a game-based learning environment, which offers children the opportunity to carry out each step of the traditional technique. At the same time it avoids the complex problems occurring during the long processes and tight sequences in producing batik pattern. In addition, the software should be enjoyable, inviting for beginners, offering at the same time numerous batik shapes and great variations of color and shade to be rich enough for continuous usage. In the end of this research, the software is supposed to be installed within the Museum Batik Pekalongan in Indonesia, as one of the research fields for the study.

Keywords—batik, digital media, game-based learning, museum, software

I. Introduction

The role of technology in creative processes is changing, given the technological advancements of recent years. Digital games as one part of creative technologies have received interest from educators for their capacity to improve learning. Motivating children through engaging interactions, they have the capacity to promote learning that goes beyond the traditional standard-based, declarative knowledge taught in schools that is offered by traditional curricula (Shaffer, 2006).

Indeed since 1970 digital games have been used for various educational purposes, for instance, teaching basic skills, reading, and calculation (Coleman, 1971). Educators, game designers and researchers have noticed the importance and great potential of digital games. Many studies have been published in the last two decades on the effects of digital games on learning. Studies in learning effectiveness address

different aspects such as assessments of skills (e.g., Schrier, 2006), abstract and conceptual knowledge (e.g., Gee, 2003), visual capacity, motor activity, and spatial abilities (e.g., Burrow and More, 2005). These assessments employ mixed-method approaches like pre- and post-domain-specific tests, questionnaires, interviews, and video analysis. Findings of these efforts suggest that gameplay can enhance learning.

Children at school at present are no longer seen as passive recipients of information but rather as active learners that should be involved in the development of their learning activities. These children were born in a multi-window multi-device society (screen and finger generation) and interact with many of these screens from an early age through a new language. Among the various researchers, Prensky (2006) comes to conclude that this new language, associated with a new way of organizing thinking is based on multitasking, hypertext and interactivity. Black and Gen (2010) have observed that children express a need for more varied forms of communication and claim to become easily bored with traditional learning methods. Because children's lives today are saturated with digital media at a time when their brains are still developing, many popular press authors claim that this generation of children thinks and learns differently than any generation before, but the evidence to support these claims is scarce. These children need self-directed learning opportunities, as well as interactive environments, multiple forms of peer feedback and assignment choices that use different resources to create personally meaningful learning experiences (Barnes, Marateo, & Ferris, 2007). As learners, they wish to construct their knowledge by themselves. They expect to be immediately engaged in the learning process.

Meanwhile, the rapid growth of the technology also gives a significant impact to cultural heritage learning. Children need to learn the culture in a way according to their affection. Technology has a powerful influence in enhancing children's learning on culture. Batik as one of Indonesian cultural heritage is brought into this study and is introduced to children in a different platform. Batik is an art form with strong tradition aspects. Some batik museums in Indonesia have huge collections of beautiful and precious batik, but it is necessary that museum also have to deliver the knowledge of producing batik, which is including the craftsmanship and the creative design. Batik museums could use the traditional method of producing batik, but the innovation in digital technology would be another option, especially for children, to teach the process of making batik.

This study will present the preliminary concept of designing a digital game for children in learning how to make

batik. The concept is based on the field research to some museums in Indonesia where the author investigated the process of producing batik in a traditional way.

II. Background and Related Works

A. Batik Tulis

Basically there are two techniques to draw melting wax to the cloth. The first technique is a traditional way using *canting*, a tool like a pen that holds a small reservoir of hot wax. This technique produces hand drawn wax-resist dyeing batik, which is known as Batik Tulis (lit: 'Written Batik'). The other technique is an automated technique; new breeds of batik, using cap or copper stamp to impress the wax design on the cloth for producing Batik Cap. This research will only discuss the production of Batik Tulis.

What makes batik unique and very fascinating are the colours and the patterns. The history and philosophy behind the patterns are also important matters that intrigue people to get to know about batik. Batik patterns can be like crackle, geometric shapes, or natural themes such as flora and fauna.

It is difficult to say how long exactly it needs to produce a piece of Batik Tulis. For sure, it needs quite a long time. Sometimes it takes three month, six months, or even one year; it depends on the patterns, colors, and length-width of the cloth. Conceptually the process for multicolor batik has 12 steps. 1) *Nyungging* - Sketching and drawing pattern on a paper. 2) *Njaplak* - Moving the drawn pattern on paper to the cloth. 3) *Nglowong* - Waxing pattern on cloth with *canting*. 4) *Ngiseni* - Putting isen (fill) to the main pattern. 5) *Nyolet* - Coloring some parts of the pattern using paintbrush. 6) *Mopok* - Covering parts that have been colored with wax using paintbrush. 7) *Ngelir* - Coloring the whole cloth by putting cloth into colored water. 8) *Nglorod* - Removing wax by pouring cloth into boiling water. 9) *Ngrentasi* - Putting dots to klowongan patterns. 10) *Nyumi'i* - Covering some parts with wax. 11) *Nyoga* - Pouring cloth into brown or sogan colored water. 12) *Nglorod* - Removing wax (once again) by pouring cloth into boiling water.

In Indonesia, these steps are an ancient method, which has been practiced since prehistoric times. The steps must be done very carefully and need high endurance. Nowadays the technique has been improved and principally only steps 1-8 are left. However it still left some constraints during the process and consumes a lot of time. These phenomenon also leads to the fact that young people and young children are not that enthusiastic learning how to make batik using the traditional technique, even though they love to wear batik clothes.

Some batik museums in Indonesia provide huge collections and conduct regular workshops making batik. However, the lack of opportunity to teach and transfer the skills of making batik is still problematic.

B. Museum for Education

In the past, the responsibility of museums was limited to acquisition, conservation, research and display of different art, archaeological, ethnographical, scientific and technological objects. But in the modern world the responsibility of the museums expanded. Visitors watch the objects, admire and enjoy them, but also learn and pass their knowledge to succeeding generations. In a museum, art objects which are most rare, most beautiful and most antique can be seen and studied freely (Singh, 2004).

What most visitors take into account is not only the rarity, but the workmanship, historical association, connection with some important discoveries, links in the development of human culture, etc. This becomes also very important. Whatever the collection is, educating the public through various educational activities is now regarded as one of the primary responsibilities of a museum. Hooper-Greenhill (1990) considers museums in the context of education, as an institution that can offer an educational experience across a wide range of variables and in relation to a wide range of institutions and organizations.

Recently, most museums have been involved in educational concerns. Sun (2013) has discussed contemporary issues and practice made in Capital Museum in Beijing, China. The museum was transferred from the old paradigm of "telling" to "engaging" with cultural, historical and scientific concepts, specifically addressed to consider education. Ferrara and Sapia (2013) have launched a project involving Polo Museale in Rome, Italy, which was a new way to use cultural heritage, regarding teachers as protagonists of communication of their subject. The project called "School and Museum: the museum object as a tool for teaching" has been a project that promoted cultural heritage resources used by teachers to design lessons within class using interactive whiteboards. Linked and Open Data technologies have been applied in this project to share cultural heritage and educational materials. More specifically, some researchers even focused their work on museums with the aim to educate children as the main target group (Karadeniz 2010, Abaci and Usbas 2010, Haden et al. 2014).

C. Craftmanship and Design Theory

Doing batik including all the procedures of the traditional ways is part of craftmanship. The interrelated steps of this craftmanship are connected to design and its variation of patterns. These patterns have been completed during the prehistoric times until today. During this time the process of batik production became a process with a lot of interconnected steps that includes physical aspects of materials, knowledge on how to process and also knowledge on pattern, ornaments and how to create new variations of pattern that meet specific aesthetic rules.

Batik museums as museums for applied design also aim to teach design methods related to practical design work. By this visitors can connect traditional craftmanship with modern

design so that craftsmanship could become a source for innovative design.

According to current design science there are specific steps, procedures and vital methods for problem solving of specific design problems. The construction of batik tool, especially for pattern development should encourage exploring design-oriented problem-solving strategies. The starting aspects for design studies are developed from design science. One aspect described by Cross (2007, 2008 and 2011) is the way designers develop design solutions. In brief designer solve a design problem by taking one aspect of it and then envisioning a potential answer to it by creating a preliminary and experimental solution. This activity is coupled with a reflection on the results as an exploration and an attempt of understanding the problem by acting. For Cross these reflexive design activities are a third way of doing research including acting in physical and abstract worlds that becomes important for current and future design education.

Jean Piaget stated that concrete, constructive, synthetic kinds of reasoning occurs relatively early in child development and such ways of reasoning had to be passed through in order to reach higher states of abstract, analytical reasoning (Fischer 1980). Furthermore cognitive development is a continuous process of interaction between different modus of cognitive (concrete, iconic and formal) and these initiate different kinds of human cognitive abilities, all of which can be developed from lower to higher levels. This emphasis on implementation of design methods in layout of interfaces and interactions of the tool is related to the educational value of design methods that focus connections between making and thinking. Here design is a type of problem solving in which the problem solver views the problem or acts as though there is some ill-definedness in the goals, initial conditions or allowable transformations. And we could conclude that one of the unique aspects of design behaviors is the constant generation of new tasks and redefinition of task constraints.

III. Preliminary Concept of Design

A. Methodology

1) Participatory Design

In recent years, participatory design has become commonplace within mainstream design practice and its application has widely diversified (J. Vines, R. Clarke, P. Wright, J. McCarthy, P. Olivier, 2013). Participatory design (known before as cooperative design) is an approach to design involving all stakeholders (e.g. employees, partners, customers, citizens, end users) in the design process in order to help ensure the product meets their needs and is usable and the knowledge and ideas of the future users are integrated from the beginning on.

In this study the participants involved are young children from International School of Bremen, Germany and from two schools in Pekalongan, Indonesia. Some experts of museums

and education will also take part in the design process of the software.

2) Development Process

The development process of the software will adopt the trial-and-error cycle of product development as described by Hippel (2014). The trial-and-error process can be planned as a four-phase cycle that will be repeated several times during the development of a new product or service (see Fig. 1). In the first phase, we conceive a problem and a related solution based on their best knowledge and insight. In the second phase, we build a physical or virtual prototype of different possible solutions we have envisioned. During the third phase, we run the experiment which means we operate the prototyped solution and see what happens. Fourth and finally, we analyze the result to understand what evolved in the trial and assess the “error information” that we got. These phases will be iterated until we get the optimal product that useful for the user.

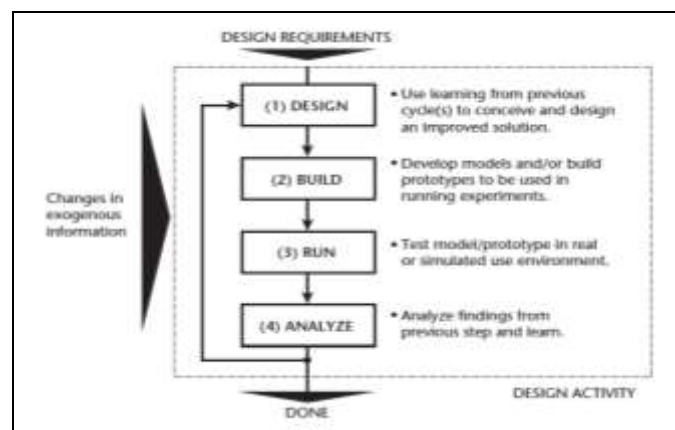


Figure 1. Trial-and-error cycle of product development (Hippel p. 64, 2014)

B. Results from Field Research

Museum Batik Pekalongan in Indonesia is a collaboration partner in this research. The museum belongs to the Government of Republic of Indonesia and has committed to support this research by providing information, being open for interviews and participating through discussions with staffs and visitors, being allowed to explore the collections and the entire museum, and attend the workshops.

Museum Batik Pekalongan has a huge collection of batik. They have approximately 1,210 pieces of batik but only 100 pieces are displayed in three exhibition rooms of the museum. The displayed collection is rotated every four months. The oldest collection is from year 1800.

Whereas there are hundreds of types of batik pattern, in 22 October 2004 the museum has legally owned 10 patterns and this is proved by certificates granted by the Minister of Laws and Human Rights, Republic of Indonesia. The 10 patterns are 1) Andang Werno, 2) Terang Bulan, 3) Buqet Long Tanahen Banji, 4) Buqetan Biru Putih Belanda, 5) Pekalongan Modifikasi Gurdo, 6) Pekalongan Modifikasi Merakan, 7) Pekalongan Modifikasi Pitik Merak, 8) Pekalongan Modifikasi Tanahen, 9) Ragam Hias Kapal Kandas Gaya Pekalongan, 10) Ragam Hias Sekrandingan.

Besides having three main rooms of exhibition, the museum also has a showroom, an audio-visual room and a large arena for conducting workshops. This museum is very aware of its function as educational place for those who are interested in batik. They manage well schedules for groups of visitor who want to have a workshop in the museum. For daily visitors, they offer a short training to do steps 3 to 6 of the process of making batik (*Nglowong*, *Ngiseni*, *Nyolet* and *Mopok*). They provide tools and materials for free. Doing these four steps in one day or a half is not possible, therefore visitors have to choose which process they want to learn. Children visitors, are normally divided into three categories:

1. Pre-school students age 4-5: They can do batik only at process 5 and 6 (*Nyolet* and *Mopok*)
2. Elementary school students age 6-8: They can do batik at process 4, 5, and 6 (*Ngiseni*, *Nyolet* and *Mopok*)
3. Elementary school students age 9-11: They can do batik at process 3 to 6 (*Nglowong*, *Ngiseni*, *Nyolet* and *Mopok*)

Fig. 2 shows some students who visited the museum had a chance to learn how to do *Nglowong* on a small piece of cloth.



Figure 2. Some student visitors learned to wax pattern on cloth with *canting* (*Nglowong* process)

During the visits to the museum, the author did interviews with two staff members and a group of students (age 14-15) who visited the museum. Staff members are familiar with batik and know how to make batik by traditional method. They said that they would be very interested if there was a digital tool developed to support their work. The students know batik but do not really understand the process of making batik. They expressed that they are really eager to learn about it, if there was a digital tool to support the making of batik. These students are familiar with computers, thus there will be no significant problems when they are introduced to a new digital tool.

The topic of offering software for children to be installed in the museum was discussed furthermore with the IT staff of the museum. In 2008, the museum got budget injection from government for procurement of computers for the museum. The computers were supposed to be used by visitors to learn

about batik. The computers are there until today, but are mainly used for browsing and searching general information in the Internet. The IT staff said that there is a long nourished wish that the museum had digital material on the computers for visitors to learn making batik in an easier way.

C. Concept and Design

It is essential to understand how the digital environment might affect children's cognitive development. In this study, there are two key issues in designing for children: 1) deciding how to translate physical environments to digital space; and 2) translating each step of the process of making batik into what children might consider a meaningful visualisation.

Another point that has to be considered is that batik is not about drawing the patterns but about including the technique and the whole process of producing batik. This has to be integral part on the tool to be designed.

Based on interviews with staff members at the Museum Batik Pekalongan, the author formulated the needs of the museum as follows:

1. The software has to offer some guidance for children to know the whole process of producing Batik Tulis. The tool would contain as visualisation that can offer a rich and memorable experience.
2. A game-based learning environment is appropriate for this purpose.
3. The game must be easy to use and intriguing for children's interest in learning batik.
4. The default (sketched) patterns used in this game are taken from 10 legal patterns owned by Museum Batik Pekalongan.
5. The game will be divided into two levels as shown in Table 1.

TABLE I. TWO LEVELS OF THE GAME-BASED LEARNING TOOL FOR MAKING BATIK PATTERNS

Children age 4-8	Children age 9-11
Step 1: Interactive visualisation of the process to begin making batik	Step 1: Interactive visualisation of the process to begin making batik
Step 2 (<i>Ngiseni</i> , <i>Nyolet</i> and <i>Mopok</i>): <ul style="list-style-type: none"> • Drawing the pattern by following dots on the object • Mixing colors • Coloring patterns with mixed colors • Removing the color if they do not like it and change it with another (mixed) color • Saving the work and getting the batik pattern ready for the next steps 	Step 2 (<i>Nglowong</i> , <i>Ngiseni</i> , <i>Nyolet</i> , <i>Mopok</i> , and <i>Ngelir</i>): <ul style="list-style-type: none"> • Drawing the pattern by following the instruction shown on the screen (could be in the form of storytelling) • Mixing colors • Coloring patterns with mixed colors • Removing the color if they do not like it and change it with another (mixed) color • Modifying the pattern: resizing, rotating, etc. • Choosing a background color for the batik

	<ul style="list-style-type: none"> • Saving the work and getting the batik pattern ready for the next steps
Step 3 (Nglorod): Interactive visualisation of the final process of making batik	Step 3 (Nglorod): Interactive visualisation of the final process of making batik

As seen in Table 1, this game-based learning tool will help children to conduct more steps in producing batik in short time when using computers instead of doing it in traditional ways. The software even gives the opportunity to easily modify children's work if needed. Furthermore, for children age 9-11, they can also learn about history and philosophy of the patterns, which could be embedded in storytelling following the process of drawing patterns.

iv. Discussing and Future Works

The design concept of this game-based learning tool must respect the aesthetic and cognitive needs of young children. Colors and shapes of the patterns can present aesthetic aspects, while the cognitive parts are addressed by interactions with the tool. One of the questions arised during studying this initial concept of design: How should an interactive artifact look like in detail in order to be appropriate and to help to visualise step 1 and 3 from Table 1? Would it be an interactive video or animated graphic?

The next steps in realizing the artifact will start immediately. This will be accompanied by developing scenarios in respect to the learning objectives. Characters have to be defined, storyboard have to be designed and first prototypes have to be developed and tried out with children and experts.

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