

Preliminary Work on Design Thinking: Addressing Challenges using Low-fidelity Prototyping with Rural Teenagers

Masitah Ghazali
ViCubeLab Research Group
School of Computing
Universiti Teknologi Malaysia
masitah@utm.my

Noraini Ibrahim
Centre of Engineering Education
Universiti Teknologi Malaysia
noraini_ib@utm.my

Norhaida Mohd Suaib
UTM Big Data Centre
Universiti Teknologi Malaysia
Skudai, Malaysia
haida@utm.my

April Lia Hananto
Department of Information Systems
Universitas Buana Perjuangan
Karawang, Indonesia
aprilia@ubpkrawang.ac.id

Sarina Sulaiman
UTM Big Data Centre
Universiti Teknologi Malaysia
Skudai, Malaysia
sarina@utm.my

Aminah Beran
Mini RTC Layang-Layang
Layang-Layang
Kulai, Malaysia
layanglayang@rurallink.gov.my

Abstract— The strength of design thinking activity lies in the participation of users in contributing ideas in the process. In this paper, we report our findings from a preliminary work which was carried out with rural teenagers. Our aim is to inculcate the critical and creative thinking among them. Low-fidelity prototyping was used as a mean to illustrate their ideas into tangible solutions in a form of mobile application. The teenagers enjoyed the brainstorming and building the mock-ups using low-fidelity prototyping sessions. They reflected that the activity made them think about what mobile applications can do and elated on the fact on how they can actually design one. We take this work as a pilot study where in this paper we will also discuss the shortcomings that need to be addressed.

Keywords— Design thinking, low-fidelity, rural teenagers, problem solving, creative and critical thinking.

I. INTRODUCTION

The explosion of information and communication technology (ICT), especially mobile phones, has transformed the development landscape of rural areas. Having mobile phones is a normalcy in any rural villages in Malaysia today, as the community mostly use the technology for communication, especially social media, where they often use this platform for marketing local businesses [1, 2]. Meanwhile, at about the same time, the Malaysian government launched the national blue ocean strategy (NBOS), to nurture and increase productivity, creativity and innovation by working collaboratively between the ministry, public servants and the civilians. One of the main focus is on the rural areas where initiatives must be of the ones that could increase the quality level of rural communities [3].

While many ICT developments in the past had looked into, and are still looking at providing services and infrastructures to the villagers [4, 5], this study taps into involvement of the rural villagers, particularly the teenagers, in the ICT development process. This approach can be seen as per described as co-creation according to [6], which by doing so, would aspire towards becoming smarter citizen. The design thinking approach will be used to realise this effort. The design thinking process, which consists of consists of empathize, define, ideate, prototype and test, [7] are used by many across multi-disciplinary domains and with various groups, as its techniques allow the participants to derive to creative solutions to address certain challenges or limitations.

This paper describes our effort in applying the adapted design thinking on rural teenagers to encourage creative and critical thinking. We will first present a brief background of the locality involved in our pilot study, then proceed with descriptions on how we carried out the activities with the teenagers.

II. BACKGROUND AND RELATED WORK

Rural transformation program (RTP) under NBOS is a continuous effort by the government to ensure rural regions could attract private investment, create job opportunities and economic activities, and encourage the youth generation to return to serve their communities [3]. Narrowing down to Johor state alone, the southeast of Johor, under the care of Lembaga Kemajuan Johor Tenggara (KEJORA) has set up six mini rural transformation centers (RTC) for the benefit of the villagers and the communities [8]. Each center is equipped with a room with computers, a space to sell products, which basically acts as a one-stop-center for various services. In our project, we aim to maximize the usage of computers in these centers by using a standalone low-fidelity prototyping tool in our activities.

The today's version of Design thinking (DT) was brought to mainstream by IDEO in the 1990s, though the history can go back to as far as 1970s [9]. The core idea behind DT as per stated by Kelley and Brown, the IDEO Founder and CEO, is, "design thinking is a human-centred approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success." [10]. Thus, it is no surprise that today, many big and giant companies such as Samsung, Google, IBM adopted DT in their business corporations.

DT has also been widely adopted in ICT development. To stay ahead in producing better innovative solutions and services, the development must be agile and rapid and tick all the boxes; from what users or clients wants (empathy) to validating by testing out the prototype. There is even a view to propose a profession of DT in ICT due to its potential in providing some real possibilities for improving software design when tying together with computational thinking. The fact that today's technology is dominated by software and technology, makes this point relevant [11].

As previously mentioned, the stages involved in DT are empathise, define, ideate, prototype and test, which this process is a continuous evolving process. According to [12], this is due to the repeatable steps undertaken, which can happen simultaneously or liner, until the best answers are discovered and selected. The elements of creative and critical thinking come into play, or integrated in DT, when performing each stage of the DT process. The repeatable and evolving blend of progressively integrated creative and critical thinking skills, is really what defined by Bloom's "critical thinking skills" in the Bloom Taxonomy [13]. These two elements fused really well together to create innovation in the DT process, as per mentioned before.

The approach of design thinking has proved to be a success in many projects in rural communities. This is true to areas mainly in India [14] and Africa [15], where in one example in India particularly, train the rural kids and youth to practice problem solving and critical thinking, as part of the design thinking, to solve problem [16]. The phase which usually gets people excited is the prototyping phase, where they get the chance to build mock working models, which carry onto building the real working prototypes. Prototypes can be of from low-, medium- to high-fidelity, with low-fidelity is close to mock working models, rough sketches, to high-fidelity which close to the end product [17].

III. METHOD

We scoped the design thinking to mobile application, as this is the closest example of the most recent ICT technology which they have access to and usually use. Furthermore, we carefully chose a software to facilitate the mock-up prototyping which uses the computer machines in the lab, to align with our aim to maximizes the usage of the computers provided at the RTC.

We sought the assistance of mini RTC officer to gather teenagers from the rural location. We mentioned that the criteria of the participants must be of teenagers and local to the place.

The questionnaires designed for this study serve several purposes. The pre-questionnaire was designed to get to know the teenager's background, the frequency they use the computers at the mini RTC, and on their exposure and usage of mobile phones. As the aim of the study is to also learn about the teenager's way of creative thinking in problem solving and critical thinking, the questions also asked, how often they come up with ideas, and what they do with the ideas. Meanwhile, for the post-questionnaire, the questions were designed to reflect as to whether the session has certain effects on them. The questions include whether the activity in some ways guided them to 'think' and properly address the 'idea'. The pre- and post- data were collected by using paper hand-outs. All recorded data were analysed and evaluated manually.

IV. DESIGN THINKING SESSION

Twelve teenagers from various nearby schools participated in our program which was held at mini RTC Layang-Layang, with 9 boys and 3 girls. The session began with a short background questionnaire. In the introductory note, we briefed about what mobile applications today can do. The activities were proceeded with groups of three members, and each group is facilitated by one facilitator. We

kicked off the session with a question, inspired by Alan Kay [18], *if you can build an application, what would it be?*

A. Emphathize

In a group, each of them was required to reflect their surroundings, daily tasks, and activities, that they find to be a challenge to kick start the empathize phase. Facilitator guided them that this can be anything from what they observe or what they actually experience.

B. Define, Ideate

Once a challenge is identified, each group then further defined what it was, before starting to think about what would be the best solutions their mobile application can offer to overcome the challenges. This was done using brainstorming and mind-mapping techniques, with post-it notes, colored pens and large papers (Fig. 1). The ideate phase adopted in this project has been slightly adapted to meet the mobile application concept.



Fig. 1. The teenagers worked in group, defining and brainstorming what and how the identified challenges can be solved

C. Prototype, Test

In order for them to be able to visualize their proposed mobile application, we used the low-fidelity prototyping approach to design and prepare the mock-ups. Pencil Project application [2] was used in this project as it is a standalone software which suits the condition of the computers at the mini RTC (Fig. 2). The teenagers took turn in creating the mock-ups, and completed at least one 'function'. They also had the opportunity to see what it is like by playing the 'function' they just created.



Fig. 2. One of the group member uses the low-fidelity prototyping to design the solution of their application

Once all phases are performed, we gathered all teams for quick pitching via brief presentation. Each group described

the challenge and their solutions, before demonstrating their prototype (Fig. 3 and Fig. 4). Other member from different teams also had the chance to try out the prototypes and gave feedback. The program ended with a quick survey on what they thought about the whole design thinking session.



Fig. 3. A group described the challenge, and their proposed solution



Fig. 4. Group members demonstrated how the prototype works

V. FINDINGS

The total of twelve teenagers whose ages range from the age 13 to 17 years old were involved (Fig. 5) in this event.

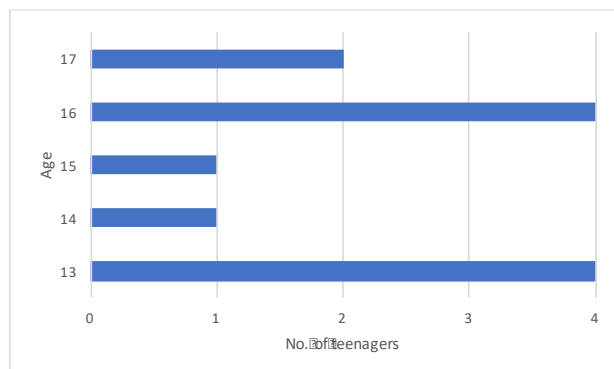


Fig. 5. Age details of the teenagers

From the pre-questionnaire gathered findings, all of them do not go to the mini RTC as often to use the computers. When asked about what they usually do if they have ideas, only 3 answered they will dwell on the ideas and thought about them further. Whilst the rest answered they never had any ideas apart from daydreaming. The survey also asked if they have smartphones, and what kind of applications they use. Out of 12, 7 said they have smartphones and they use them for social media applications such as WhatsApp,

WeChat, Instagram, besides games and watching videos on YouTube (Fig. 6). Apparently, they are not aware of other types of applications with other specific purposes, for e.g. online shops, fitness, maps, learn new languages, etc. They were quite amazed and excited to know that applications are actually of various kinds to facilitate our daily chores and activities.

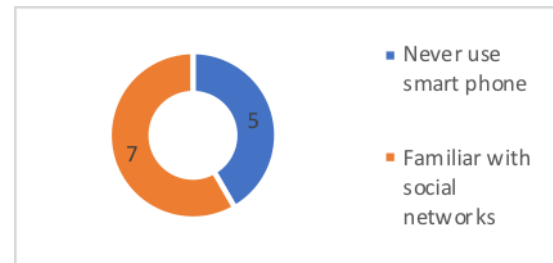


Fig. 6. Number of teenagers on smart phone usage

The post-questionnaire survey, meanwhile, shows promising results. Using a smiley-o-meter [7], all of them rated the program as good, very good and awesome! To them, this program gave them insights into something new and actually made them think – when they were asked to identify challenges and to find suitable solutions. They really enjoyed the hands-on activity to design the low-fidelity prototypes, and few mentioned they liked the work-in-group activity (Fig. 7).

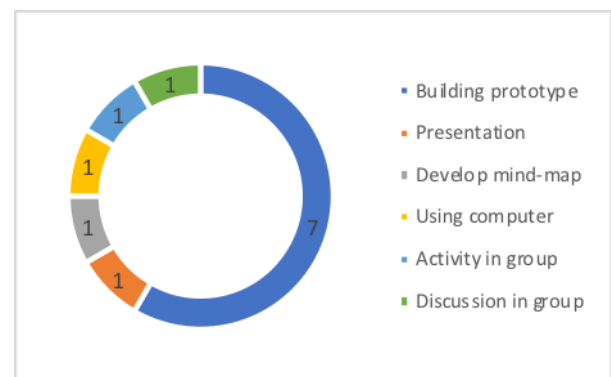


Fig. 7. Number of teenagers and their preferences on the activities

Meanwhile, when asked what they disliked throughout the program, 2 of them said it was during the pitching session. We asked again, if they would return to Mini RTC again to use computers after this - 2 said yes, and 9 said maybe. When asked about the program in general, 7 of them said they would like to repeat the same activities that involved thinking/brainstorming and designing the prototype (Fig. 8), which shows some potentials for them to hold on to their ideas and do something about it.

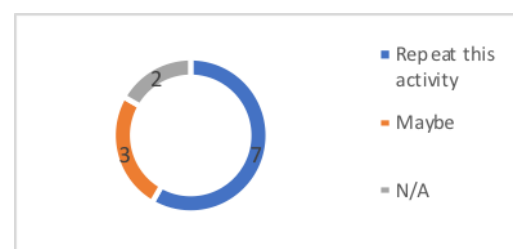


Fig. 8. The likeliness the teenagers to repeat the activity again

VI. REFLECTION

The motivation behind our program with the community is to nurture the creative and critical thinking skills among the rural teenagers. We do this by adopting and adapting the design thinking approach [1,6] in which we suited the prototyping with a low-fidelity prototyping tool to in line with the objective of the mini RTC, i.e. to fully utilize the computers which are already available at the center. For the teenagers to empathize, define and ideate, proved to be difficult or challenging, and it was totally the guidance of the facilitators that these can be overcome. Asking the teenagers to evaluate their surroundings or their daily routines to get some ideas for a proposed mobile application was not an easy task. This is due to the fact that they find their life satisfactory and there is no need for any mobile application. The facilitators then used creative approaches to spark some ideas.

From this preliminary study, in order to address the above shortcoming, a storytelling approach is deemed to be more suitable. Asking the teenagers to explicitly mention the challenges, or, to provide answers to the question posed earlier, proved to be quite overwhelming to them. Thus, training for the facilitators is deemed to be a necessity in order to familiarize with other techniques and approaches available in the design thinking process. Also, it is observed that some of the questions distributed before and after the surveys also need to be improved. After analyzing the answers, there are some answers that we thought might be understood differently. For instance, questions on would you like to do the activity again on (i) brainstorming (empathize and define) and design (ideate and prototype) (ii) would you use the tool again at mini RTC, could mean the same thing to some of them.

The findings that we obtained from this program will be addressed in order to improve the shortcomings. We treat this project as our pilot study in which we had obtained better insights into what suitable approaches to be used to gain and to measure how program such as this had impact in the lives of the rural teenagers.

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