The utilization of Scratch application in making music controller to introduce traditional musical instruments

J Julia1,*, P D Iswara1 and T Supriyadi2

1 Program Studi PGSD UPI Sumedang, Universitas Pendidikan Indonesia, Jl. Dr. Setiabudi no 229, Bandung 40154, Jawa Barat, Indonesia
2 Program Studi PGSD Penjas Sumedang, Universitas Pendidikan Indonesia, Jl. Dr. Setiabudi no 229, Bandung 40154, Jawa Barat, Indonesia

*juli@upi.edu

Abstract. Introducing traditional musical instruments to the students in the digital era needs to be facilitated by utilizing several devices, such as a computer keyboard or a laptop as music controllers. By utilizing a computer keyboard as a music controller, the students can recognize the characteristics of sounds, and play melodies from traditional musical instruments in simpler ways. Therefore, this research aims at describing the utilization of Scratch application in controlling music production through a computer keyboard. This paper uses qualitative methods with the following steps: (1) install the Scratch, (2) make the sound buttons, (3) input the sound from traditional musical instruments, and (4) set the sound buttons according to computer keyboard. The production of the music controller has resulted in teaching media used for introducing the sound of traditional musical instruments and playing a series of melodies based on the availability of tone structures in a computer keyboard. The melodies can be played in single-tone, two-tone, and/or more patterns. To conclude, the utilization of the Scratch as music controllers has potentially facilitated the introduction of traditional musical instruments in the digital era to the students. The implication is that it needs to involve technology in introducing traditional musical instruments.

1. Introduction
Children today love electronic devices such as computers or laptops. Computers have become an integral part of their daily lives [1-3]. They can promptly operate simple applications contained in the computer. This capacity can be exploited so that they can learn to recognize the sound of traditional musical instruments in an easier way, including learning to play a series of melodic songs through the sounds of traditional musical instruments. The approach is by using a computer keyboard as a music controller. Changing the computer keyboard to function as a traditional musical instrument controller needs an application to support the sound recording of traditional musical instruments, and make buttons to sound them through a computer keyboard. One application that supports the above possibility is Scratch, i.e. an application that has a fairly simple-rich programming language [4-7]. Scratch is a teaching tool and is as useful as a beginner's programming language for students as simple programming languages for teachers to use as educational tools, programs, and presentations in their classes [8].

Previous research has provided various directions and results regarding the use of Scratch applications in music production projects, such as Fields, Vasudevan and Kafai [9], Ruthmann, Heines, Greher, Laidler and Saulters II [10], and Adams and Webster [11]. In particular, Julia, Supriyadi and
Iswara used Scratch in developing traditional musical instruments to explore teaching materials production for traditional musical instruments by combining Music Notation Software with Virtual Studio Technology [12]. Julia, Iswara and Supriyadi have also succeeded in recreating traditional musical instruments that can be sounded by touch through the integration of several hardware and software, including Scratch application [13].

Different from previous studies, this study aims to develop ways to introduce the sound of traditional musical instruments by sounding it through a computer keyboard. In other words, learners can ring and recognize traditional musical instruments, including playing a series of melodic songs by pressing the buttons on a computer keyboard. Through this method, it is expected that learners can easily recognize traditional musical instruments and can explore song melodies.

2. Methods
This study tries to explore the possibilities of developing techniques to introduce traditional musical instruments to children. Therefore, this research was conducted using qualitative methods with material design without field testing. In other words, this paper is describing the making of a music controller prototype using the Scratch application. Various materials used for this study consist of computer devices, recording devices, traditional musical instruments, loudspeakers, and Scratch applications. The steps taken in this study are: (1) install the Scratch, (2) make the sound buttons, (3) input the sound from traditional musical instruments, and (4) set the sound buttons based on a computer keyboard. The sound of traditional musical instruments used as an example in this project is angklung.

3. Results
There are four main steps in making a traditional musical instrument controller by using the Scratch application. Those four steps are explained as follows.

3.1. Install the scratch
The first step in processing this project is installing the Scratch application from the developer webpage. The Scratch application is available for free at the https://scratch.mit.edu/ webpage. Using Scratch can be done online and offline. The researcher used an offline editor to work on this project. The offline version of Scratch is downloaded via the webpage https://scratch.mit.edu/download/. Figure 1 shows the main page of Scratch, and Figure 2 shows the initial appearance of the offline version of the Scratch application that has been installed on the computer. Version 2 Scratch offline editor is currently available.

![Figure 1. The main page of the Scratch web application.](image-url)
3.2. Make the sound buttons

The second step is making the buttons to represent each note from the traditional musical instruments sampled. The researcher used angklung in this project so that the number of buttons made follows the number of tones in a row of angklung. Button shapes can be made as we wish. For example, it is made pursuant to the image of its musical instrument, or it is made in other simpler forms. The researcher makes tone buttons in a simple form, namely round shape and each key are given a marker letter for the tone sequence in angklung. Figure 3 shows the shape of a button that has been made from a low G to a high C tone range. The right column is the place to make a button, and the left column is the result. Buttons can be sorted freely and can be given different colours as we need.

Figure 2. Scratch application preview.

Figure 3. Sound keys that have been made.
3.3. Input the sound from traditional musical instruments

The third step is inputting sound examples from traditional musical instruments. To get high-quality sound, we do the process of taking sound or recording independently or not recorded directly through the Scratch application. Angklung is recorded one by one using a condenser mic and Presonus AudioBox recording device, and the sound of the recording results is edited to get a clean sound and obtain sound duration as needed. Figure 4 shows the position of the button (left) and the menu for inputting sound (right). The way to input sound is to press one of the buttons in the left column at the bottom (Sprites), and input the sound in the right column by pressing the file explorer icon to take a sample of sound from the disk on the computer. The similar steps are done to each button.

![Image](image.png)

**Figure 4.** Inputting sound from a computer disk.

3.4. Set the sound buttons according to computer keyboard

The final step is setting each button to synchronize it with the computer keyboard. Scratch is equipped with facilities to give commands simply through the Scripts the main menu. We only use two commands for this project, i.e. the command from the Event submenu in the form of the "when ... key pressed" (first command) and the command from the Sound submenu in the form of "play sound ..." (second command). Through this application, the first command is connected to the computer keyboard buttons and the second command is connected to the sample sound that has been inputted from the computer disk. We sort tones from low G to high C (25 tonnes) by using the keys sequence on the computer keyboard starting from Q-W-E-R-T-Y and so on (Q to N). Thus, the sounds that have been inputted one by one can be sounded by pressing the buttons on the computer keyboard. The sound can be sounded as long as the Scratch application is active on the computer and the sound samples remain in the place/folder. After being tested for sound, the sound can be sounded from one sound to several sounds on one tap. That is, not only can you play melodies, but you can also play chords. The short and long of the sound, when pressed on a computer keyboard, depends on the length of the input sound. To get a loud sound, the computer is better connected with loudspeakers.
4. Discussion
The results of this project show that the process of utilizing Scratch to be included in applications that help music education can be done quite simply. This also shows that the selection of the right technology can create simple media that are useful for music education. The presence of various challenges in this modern era in conserving traditional music can be anticipated, among others, through the use of applications such as Scratch. Through the process of digitizing traditional music as in Scratch, at least it doesn't really eliminate its acoustic character, or at least, it still has an electroacoustic character. This aspect still needs to be maintained in the midst of a new era of globalization that generates modern music as part of cultural wealth conservation [14].

Integrating technological elements into music education is indeed not easy, because it requires the skills of the educators in terms of technology literacy. Music educators who are accustomed to conventional teaching models must work hard to enter the world of music-technology, especially for teachers who focus on teaching traditional music. Technology that supports music education is indeed available quite a lot, such as MIDI, VST, Audio CD, and others. However, the results of previous studies have proven that teachers are always the key to the quality of teaching in the field of music, and music technology is only a tool within the process [15,16]. In addition, technology in learning music is not only useful for helping the teaching-learning process, but also for revolutionizing daily music practices [17-19].

5. Conclusion
To conclude, the Scratch application is very user-friendly to be used as a material for the development of music education, especially to introduce the sounds of traditional musical instruments. Through Scratch application that can be connected with buttons on a computer keyboard, educators can record the sound of any musical instrument and introduce it to the learners. Therefore, instructors of traditional musical instruments can use Scratch for technology-based teaching needs without eliminating the acoustic sound character of traditional musical instruments.

References
[1] Hatzigianni M and Margetts K 2012 ‘I am very good at computers’: young children's computer use and their computer self-esteem European Early Childhood Education Research Journal 20 3-20
[2] O'Brien L M and Giles R M 2006 For Parents Particularly: Connecting Kids and Computers Childhood Education 83 108-109
[3] Ivarsson J 2003 Kids in zen: computer-supported learning environments and illusory intersubjectivity *Education, Communication & Information* 3 383-402

[4] Resnick M 2009 Scratch: Programming for all *Commun. Acm* 52 60-67

[5] Collobert R, Weston J, Bottou L, Karlen M, Kavukcuoglu K and Kuksa P 2011 Natural language processing (almost) from scratch *Journal of machine learning research* 12 2493-2537

[6] Maloney J, Resnick M, Rusk N, Silverman B and Eastmond E 2010 The scratch programming language and environment *ACM Transactions on Computing Education (TOCE)* 10 16

[7] Malan D J and Leitner H H 2007 Scratch for budding computer scientists *ACM Sigcse Bulletin* 39 223-227

[8] Kte’pi B M A, Scratch (programming language), in *Encyclopedia of Science*. 2018, Salem Press.

[9] Fields D, Vasudevan V and Kafai Y B 2015 The programmers’ collective: fostering participatory culture by making music videos in a high school Scratch coding workshop *Interactive Learning Environments* 23 613-633

[10] Ruthmann A, Heines J M, Greher G R, Laidler P and Saulters II C 2010 Teaching computational thinking through musical live coding in scratch Proceedings of the 41st ACM technical symposium on Computer science education ACM 351-355

[11] Adams J C and Webster A R 2012 What do students learn about programming from game, music video, and storytelling projects? Proceedings of the 43rd ACM technical symposium on Computer Science Education ACM) 643-648

[12] Julia J, Supriyadi T and Iswara P 2019 The development of angklung composition teaching materials using Music Notation Software with virtual studio technology integration Journal of Physics: Conference Series IOP Publishing) 1157 042005

[13] Julia J, Iswara P D and Supriyadi T in press Redesigning and Implementing Traditional Musical Instrument in Integrated Technology Classroom *International Journal of Emerging Technologies in Learning*

[14] Canazza S and Vidolin A 2001 Introduction: Preserving electroacoustic music *Journal of New Music Research* 30 289-293

[15] Webster P R 1998 Young children and music technology *Research Studies in Music Education* 11 61-76

[16] Webster P R 2002 *Music Technology and the Young Child*, in *The Arts in Children’s Lives: Context, Culture, and Curriculum*, L. Bresler and C.M. Thompson, Editors (Springer Netherlands: Dordrecht) p 215-236

[17] Cheng M 2018 Introducing motion-capturing technology into the music practice room as a feedback tool for working towards the precision of rubato *Journal of Music, Technology & Education* 11 149-170

[18] Guillén-Gámez F D, Álvarez-García F J and Rodríguez I M 2018 Digital tablets in the music classroom: A study about the academic performance of students in the BYOD context *Journal of Music, Technology & Education* 11 171-182

[19] Bovin A J 2018 The effects of frequent use of a web-based sight-reading software on eighth graders’ music notational literacy *Journal of Music, Technology & Education* 11 131-147