

# YOU-TRY-IT: SKETCHTIVITY: PUTTING THE “A” IN STEAM EDUCATION

You-Try-It Demonstration

**Marie Isokpunwu, Cedar Ridge High School, marie\_isokpunwu@roundrockisd.org**

**Randy Brooks, Lovejoy High School, randy\_brooks@lovejoyisd.net**

**Eric Mott, Giddings High School, emott1@austin.rr.com**

**Blake Williford, Sketch Recognition Lab, TAMU, bwilliford@gmail.com**

**Matthew Runyon, Sketch Recognition Lab, TAMU, matrunyon@email.tamu.edu**

**Dr. Tracy Hammond, Sketch Recognition Lab, TAMU, thammond@cse.tamu.edu**

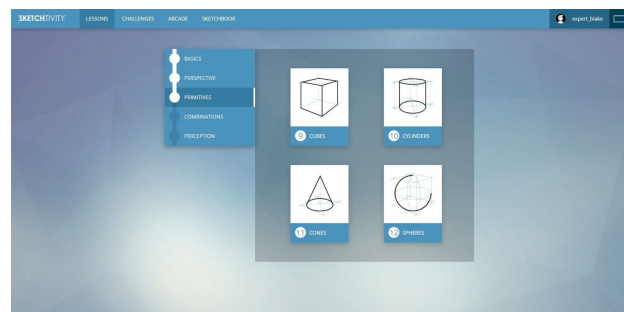
## 1. Abstract

In the era of STEAM education, learning artistic skills, and particularly how to sketch and communicate visually, is increasingly valuable. SketchTivity is a pen-based educational application that can be used for learning sketching. The system is web-based and can be used on a variety of devices with an internet connection. It guides the user through interactive sketching lessons on the basic fundamentals. It provides sketching challenges as well to encourage creative application of those skills. Lastly, it entails a novel sketch-based game called *ZenSketch* that uses gameplay to encourage quality freehand line work. This application gives students immediate feedback on their sketching by providing relative scores for precision, smoothness and speed. The use of SketchTivity should allow students to become more comfortable and confident with sketching as well as improve their sketching ability overall. We believe that students can become more expressive communicators and better problem solvers by using this system.

## 2. Context and Motivation

In 2012 John Maeda called for “A” to be added to STEM education movement - In other words adding art and design to the other crucial skills of science, technology, engineering, and math.[7] Creative problem solving and an artistic approach is needed more than ever in an increasingly complex and collaborative world.

Drawing is a particularly important skill for the 21st century. This visual modality provides a way for engineers, designers, scientists, and teachers to communicate their ideas quickly and clearly. SketchTivity teaches a form of drawing known as *design sketching* or *conceptual drawing*. This type of drawing is focused on quickly and effectively sketching 3-dimensional forms in perspective.[6] It borrows from traditional Industrial Design pedagogy, which emphasizes a solid foundation in basics (lines, circles, squares, etc), perspective, and 3-dimensional primitives (cubes, cylinders, cones, etc.), before eventually moving on to more complex combinations of primitives. The learner



**Figure 1: An example of one of the lesson overviews**

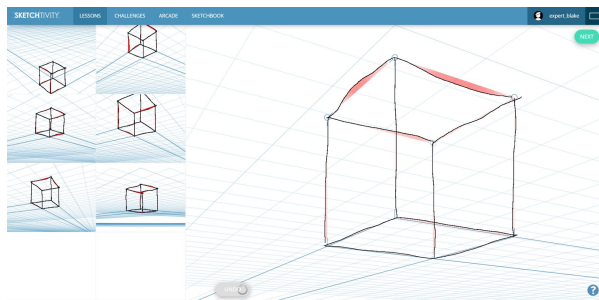
will be initially greeted by a lesson overview screen, seen in Figure 1, which shows each learning module, and follows a sequential mastery-based approach to learning.

The core motivation in developing SketchTivity is the research that shows how difficult learning to draw can be, especially in traditional studio environments where students may be subject to comparison with peers, inadequate time spent with their instructors, and too little feedback to have strong self-efficacy and motivation.[2] This often results in feelings of learned helplessness.[1]. SketchTivity seeks to better motivate learners with real-time feedback and a sense of achievement that is difficult to find in conventional settings. The feedback is intended to help users evaluate their own performance and help them identify areas of improvement. Pre-testing and post-testing also exists for external learning assessment.

### 3. Background and Pre-Existing Work

SketchTivity is a web-based application to aid students learning perspective sketching. Because SketchTivity is web-based, it can be easily accessed on almost any device regardless of operating system. It is intended for use on a device with stylus capability.

Existing work in the area of art education and creativity-support tools includes the Drawing Assistant [3], SketchSketch Revolution [4], Draco [5], Gamicad [8], PortraitSketch [9], and others. However, most of the previous work in this area are either desktop applications or add-ons for large, professional desktop applications. Our program is the first to bring intelligent drawing education to the web, providing access to many people that would not be able to use the other projects. Our program also has a unique approach to intelligent, real-time feedback using sketch recognition, and builds off of a strong pedagogical foundation. This pedagogy has produced thousands of skilled designers and artists.



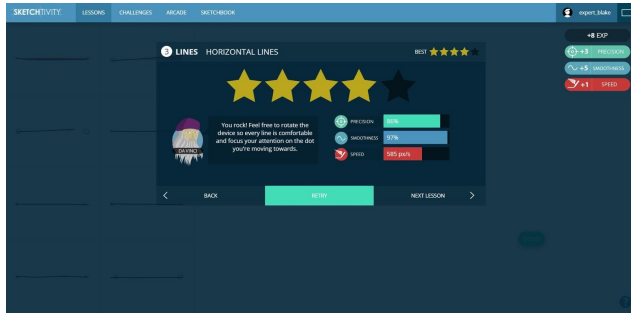
**Figure 2: The cube lesson with real-time feedback**

shows performance for that lesson, depicted in Figure 3. The user will get a tour of the program's interface as well as the planned direction of SketchTivity. Finally, the user will be encouraged to access SketchTivity on whatever internet enabled device they happen to have on them.

### 4. Overview of Demo

SketchTivity will be demonstrated on Microsoft Surface Pros, which are capable of both pen and touch interaction. The user will be guided through the registration process and will complete various interactive lessons, challenges, and games at their leisure. They will complete the line lesson as in Figure 2, and work their way towards more advanced lessons like cubes and cube combinations. At the end of each lesson, there will be an evaluation screen that

The demo will show the educational potential of touch and pen based interfaces on the web. Showing the interactive lessons and unique mechanics will demonstrate the potential benefits to students in terms of improving sketching ability, motivation to practice, self-efficacy, and self-regulated learning. Showing that it can be accessed anywhere with internet connection and on any device will demonstrate the easy



**Figure 3: An evaluation screen**

accessibility of the project, and the importance of that accessibility in allowing as many people as possible to use the software. We also hope to gain valuable feedback on the system for its future direction.

## 5. Acknowledgements

This material is based in part upon work supported by the National Science Foundation under Grant Numbers 1441331 and 1441291 and by Microsoft (Surface Hub Grant). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation nor Microsoft. The authors would also like to thank the other members of the Sketch Recognition Lab who contributed to the design and development of SketchTivity, as well as our collaborators at the iDREEM Lab and the School of Industrial Design at the Georgia Institute of Technology.

## 6. References

- [1] Brown, I. & Inouye, D.K., 1978. Learned helplessness through modeling: The role of perceived similarity in competence. *Journal of Personality and Social Psychology*, 36 (8), 900.
- [2] Carrato, P. & Kellogg, C.G., 2004. Scared to sketch: The lost art of drawing. *Structural Engineer*.
- [3] Iarussi, E., Bousseau, A., & Tsandilas, T. (2013, October). The drawing assistant: Automated drawing guidance and feedback from photographs. In *ACM Symposium on User Interface Software and Technology (UIST)*. ACM.
- [4] Jennifer Fernquist, Tovi Grossman & George Fitzmaurice. (2011). Sketch-Sketch Revolution: An Engaging Tutorial System for Guided Sketching and Application Learning *UIST 2011 Conference Proceedings: ACM Symposium on User Interface Software & Technology*. pp. 373-382.
- [5] Kazi, R. H., Chevalier, F., Grossman, T., Zhao, S., & Fitzmaurice, G. (2014, July). DRACO: sketching animated drawings with kinetic textures. In *ACM SIGGRAPH 2014 Posters* (p. 5). ACM.
- [6] Koncelik, Joseph A., Reeder, Kevin (2008). *Conceptual Drawing*.
- [7] Maeda, John. "STEM to STEAM: Art in K-12 is key to building a strong economy." *Edutopia: What works in education* (2012).
- [8] Wei Li, Tovi Grossman & George Fitzmaurice. (2012). GamiCAD: A Gamified Tutorial System for First Time AutoCAD Users *UIST 2012 Conference Proceedings: ACM Symposium on User Interface Software & Technology*. pp. 103 - 112.
- [9] Xie, J., Hertzmann, A., Li, W., & Winnemöller, H. (2014, October). PortraitSketch: face sketching assistance for novices. In *Proceedings of the 27th annual ACM symposium on User interface software and technology* (pp. 407-417). ACM.