

design sketching: a newfound skill

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Introduction

In the article "Design Sketching: A Lost Skill," published in the May/June 2021 issue of *Technology and Engineering Teacher* (Kelley, 2017), the author makes the case that although design is at the core of technological literacy and necessary content for technology education, many K-12 educators struggle to teach sketching in their classes. Furthermore, the case is made that technology education, by the nature of the profession, focuses on advanced technologies. Therefore, technology teachers often focus on teaching the time-consuming software programs, such as CAD, that reduce instruction time for fundamentals like sketching (Kelley & Wicklein, 2009; Warner & Morford, 2004). Ironically, most parametric modeling programs begin in the "sketching plane" so it would make sense to teach sketching techniques to students early and often throughout their study of technology. Furthermore, sketching is an excellent brainstorming approach that improves students' 21st



Image 1.
Purdue
SketchSquad
Team

Converge 2018

century skills including critical-thinking, communication, and, when working in teams, collaboration.

The purpose of the "Design Sketching" article was to raise awareness of this often-overlooked fundamental design skill. Many teachers responded positively to the article and confirmed that teaching sketching is a challenge in K-12 classrooms. Additionally, teachers indicated that, like creative confidence, students lack confidence in their sketching abilities and teachers also often struggle to be confident in teaching sketching. Today, students and teachers have moved away from paper and pencil or pen platforms to digital outputs on devices such as Chromebooks, iPads, and standard computers, adding to a lack of familiarity with design sketching. Additionally, teachers expressed the desire to teach design sketching, but lack fundamental skills to do so effectively. Some *Technology and Engineering Teacher* readers have requested that the author provide sketching techniques to help them teach young learners how to improve their design sketching. This article is in response to these requests. The author (Kelley) will be the first to admit personal struggles in teaching design sketching and some lack of confidence in teaching this important design skill. Fortunately, he was able to locate experts in design sketching to provide some necessary fundamentals that any K-12 teacher can teach to students come Monday morning.

Revisiting the "Design Sketching: A Lost Skill" article (www.iteea.org/111394.aspx) will provide necessary information to help introduce the topic to your students and also provide necessary teacher follow-up questions to help students improve sketches they create. These strategies are necessary to help orient students to the importance of design sketches in the first place. Class discussions on the topic can also help overcome misconceptions such as: to be good at sketching, designers have to be artistic. On the contrary, the authors will shatter this misconception by sharing some basic

fundamental sketching techniques that anyone can accomplish with a little practice.

The following Standards for Technological and Engineering Literacy (ITEEA, 2020) are addressed when applying the concepts discussed in this article.

- Grades K-2 STEL-7D Discuss that all designs have different characteristics that can be described.
- Grades 3-5 STEL-7N Practice successful design skills.
- Grades 6-8 STEL-7V Improve essential skills necessary to successfully design.
- Grades 9-12 STEL-7AA Illustrate principles, elements, and factors of design.

There are other key *STEL* standards also addressed when teaching design sketching, but these are a few that directly relate to this key design skill.

Freehand Design Sketching

When it comes to brainstorming, speed is the name of the game. It's about getting ideas out as quickly as possible in order to create a large quantity of ideas from which to select for further development. Quantity is a common brainstorming technique (Mentzer, Farrington, & Tennenhouse, 2015). Another "golden rule" of brainstorming is: "There are no bad ideas." However, there are lost ideas. Before exploring how an idea gets lost, it is important to first understand how to start the brainstorming process. While brainstorming with a group of people, designers often either stare at a blank piece of paper while digging through their memories and thoughts or look around the room hoping to spark a jolt of inspiration. Once the designers have locked down an idea, it is time

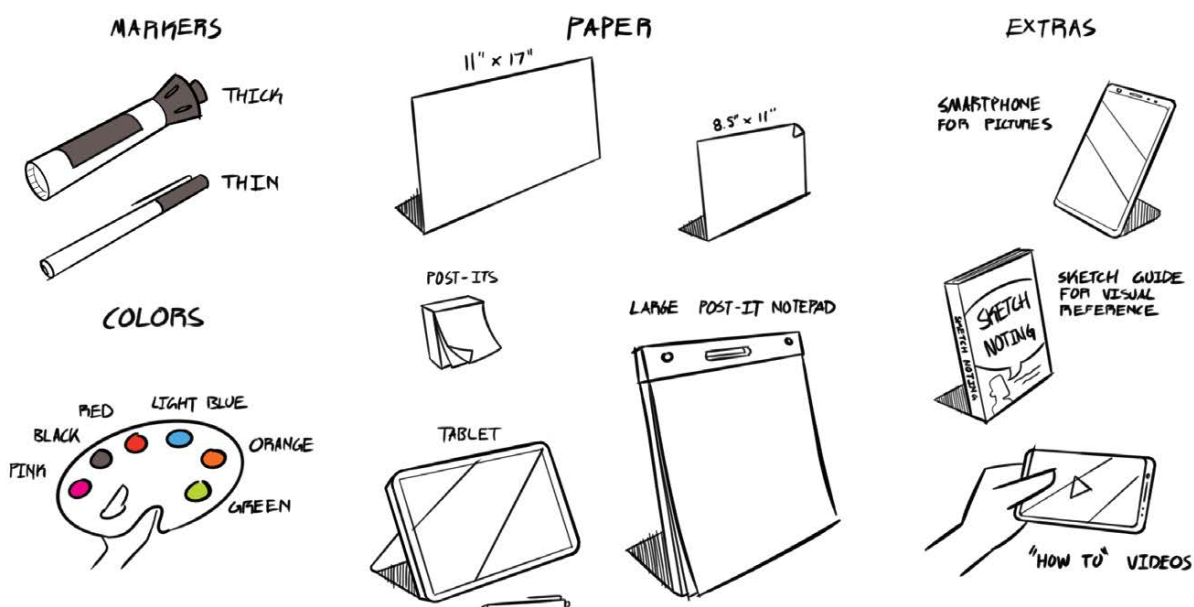


Figure 1.
Tools of the
Trade: Design
Thinking

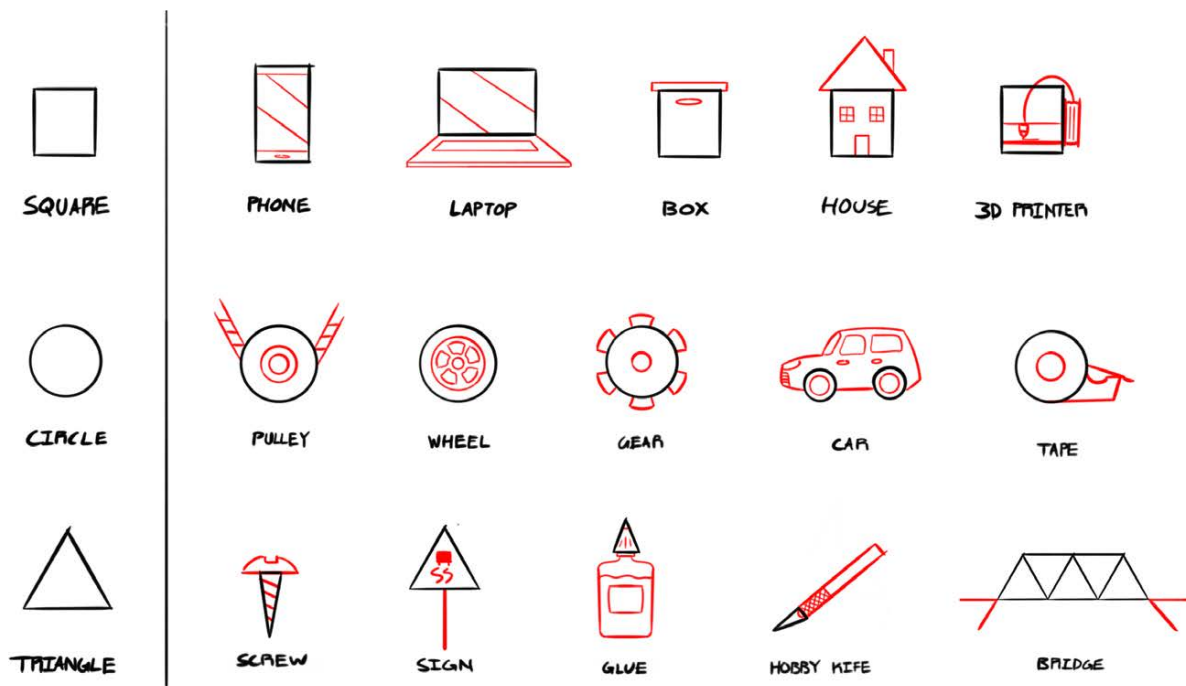


Figure 2.
Drawing
Objects

to share it. This is the part of the brainstorming process that gets tricky. A designer might ask themselves “How do I show this awesome idea so others can see the potential I see in it?” The designer might also think “How do I convey the essence of this complex idea?” and “Where do I begin?” These thoughts may run through a designer’s mind while, at the same time, mentally holding on to the new idea. This may become fairly stressful and, as a teacher, it is important to acknowledge and understand this tension that your students may experience. Ideally, a teacher of design wants students to learn how to show their idea visually, however that’s not a natural part of their designer toolkit yet. They do what is familiar and write down the details of this idea. Another common approach is for designers to describe ideas with their hands, gesturing design solutions. Using these techniques, the designer presents the idea to the team, and, to their surprise, the team may not fully understand the idea because it lacks a visual context. Here is where the design idea can be lost forever. It is helpful for teachers to be aware of this threat and work to prevent students from losing their design ideas. A key aspect of design is not only developing an idea and refining the concept until the idea is refined, but also for the designer to have others who understand and comprehend the idea. Remember, one key element to being granted a US patent is to have others who comprehend the design idea. This is where freehand design sketching may be a more powerful tool than mechanical drawings while brainstorming. Freehand design sketching is much faster to produce and focuses on the idea rather than on the details, making it perfect for brainstorming. Rather than focusing on all the details of the idea, it is more effective for the designer to capture the bigger picture behind the idea and convey that first. The smaller pieces can be thought through later, once the idea is confirmed as a possible design solution. If the overarching design idea is not sound, no matter how detailed the sketch is, it is not going to last.

Many teachers use a whiteboard as the class brainstorming palette and although this suffices, it is not the only option, and may have some constraints that limit students’ ability to share ideas. A whiteboard might very well be as crippling as a stage and podium is for a pupil with stage fright. Figure 1 illustrates some options for teachers to provide to students and have available in the classroom. There are a variety of options for design markers, sketch books, as well as digital tablets, digital whiteboard, and flipchart paper. Recently, the author (Kelley) taught a design class at the undergraduate level using a hybrid class approach—some students in the classroom and others using distance technology. A collaborative brainstorming session was created with the entire class of 50 students using an app that allowed all students to add to the whiteboard. Virtual Post-it® notes used to brainstorm ideas and students later shared that it was one of their best collaborative sessions. They liked the anonymous element where they could share an idea without people knowing it was theirs. Another student said that in most brainstorming sessions, she struggles to share her ideas because she is often not heard in a loud crowd of students and the virtual whiteboard app eliminated this barrier.

It is recommended that teachers review the variety of resources both in book form as well as DIY and “how to” sketching videos. Some videos can be obtained for purchase but there are numerous very good free sketching resources. It is also encouraged for teachers to consider adding sets of designer tools (as illustrated in Figure 1) to their classrooms.

Fundamentals of Drawing Objects: Basic Shapes

Students often get overwhelmed drawing objects with many details. They sometimes become so focused on trying to draw the

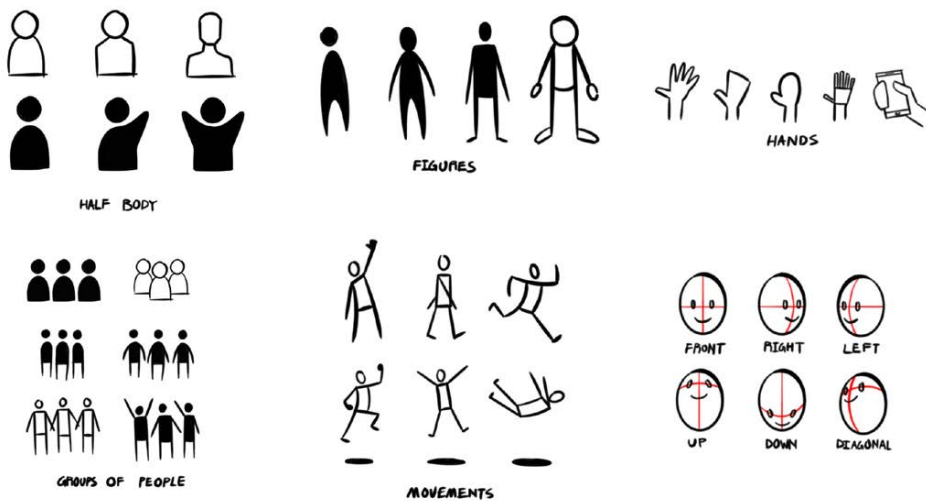


Figure 3. Drawing People

crowds of people or show people sitting. Action illustrations show people in motion by using arm and leg appendages as well as shadows for action and depth. Hands are equally hard to draw so, again, simplify them and eliminate unnecessary details such as fingers. Mitten-like shapes can communicate a hand with limited details; add an object such as a phone to provide necessary context. It is good practice to allow students to view other reference materials or consider examples on the internet such as flaticon.com, which provides thousands of simple icons representing objects and people. Reference tools are just that, a reference—not a step-by-step set of instructions. The reference allows students to picture the basics of the object. They can make the sketch their own by adding additional details, changing the perspective or, as already mentioned, change the context by adding other objects. Figure 3

details that they get overwhelmed and give up—assuming they are not good at sketching. Like many skill developments, breaking the operation down to its basics is often an effective approach. Consider demonstrating to students that many objects can be sketched from three basic shapes of a circle, square, or triangle and that each of these shapes can be combined with other shapes to form many of the objects in our world. Figure 2 shows how to start with basic shapes (dark lines) and then add details (lighter lines).

People are often difficult categories to draw. Geometric shapes aren't very useful to create people but there are other simple techniques. Figure 3 illustrates simplifying people by focusing on one element or reducing the details to basic elements. The half-body illustrations could be useful to illustrations that need to represent

illustrates various ways to draw people from basic star shapes to stick figures with action. Star-shaped people eliminate details that are hard to draw quickly—like hands and feet—but still provide enough detail to illustrate people, add additional objects, and a person in context emerges. Often the context dictates the need or elimination of some details, for example people in a sports stadium can be achieved by drawing only their top halves to show a crowd of people sitting down. Notice the action sketches in Figure 3, the shadow helps to show motion of the stick figure sketches.

Adding people details to a sketch is challenging, but also sometime necessary in order to provide additional, yet necessary, context. Teddy Lu, founder of SketchSquad at Purdue created an easy-to-use template of people (see Figure 4). He taught Purdue students how to quickly create the basic outline of a person's head and then change the various features to make a sketch that of a male or female, young or old. Additional details can add a new context, such as a sketch of a student, a type of worker, etc. These kinds of people sketches are great for highlighting important figures such as interviewees, experts, teachers, teammates, etc.

Additional Objects Create Context

As mentioned previously, adding additional details to a sketch can add the right context to communicate many elements of an idea, a scene, or situation students might want to sketch. For example, in Figure 5, the illustration shows a simple side view of a person's fist. This sketch does not really communicate much and one might not know it is a sketch of a hand, but with a hammer or a coffee cup, and you add a context that quickly and clearly communicates a hand. An object's perspective or scale can be communicated by adding additional details, such as a house sketch with a person or car in front. A larger scale is demonstrated by drawing those objects much smaller than the house. Switch the scale around and

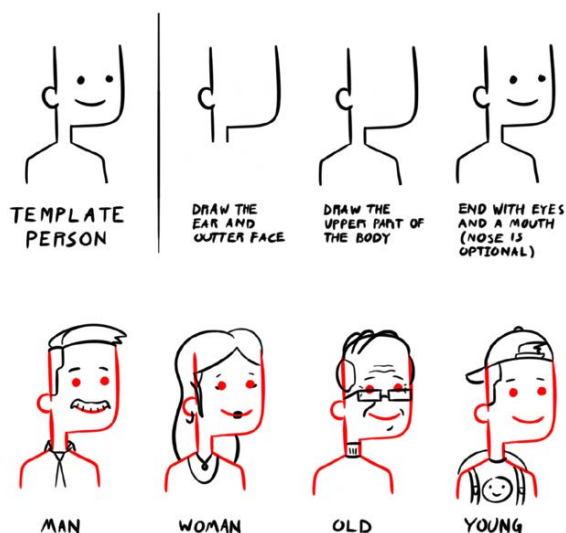


Figure 4. Teddy People

draw the person large and the house small and you have a doll house—same house sketch but different context.

Design Drawing Fundamentals

"Design Sketching: A Lost Skill" encourages teachers to demonstrate to students how to use key elements of a design drawing that are fundamental to communicating ideas. These elements include labels or annotations, symbols, and various views of the object to communicate design ideas. Figure 6 illustrates sequences of events to illustrate a process. The sketches demonstrate an order of things using numbers as well as arrows to guide the viewers' eyes through the sequence of steps in the process. Rube Goldberg uses this approach to communicate his crazy cartoon-strip contraptions; much of the fun of his drawings is to work through the drawing with your ideas to understand a complicated process. Figure 6 also shows the many ways to create process arrows.

Quick and Nimble

A key to brainstorming is getting those design ideas flowing. Students should not get caught up in the details of the design, but rather put the idea out there for later refinement. In Figure 7, Taylor created a quick sketch on the right and a detailed sketch on the left. He purposefully positioned the car sketch to show just the side view to get the design on paper quickly. The drawing on the left is an angled perspective sketch showing details of the front and the side of the car. This approach is great for showing some key features and other details of the car design but aren't necessary for a conceptual sketch in a brainstorming session.

Multiple Iterations, Refining Design Ideas

The author (Kelley) requires students to create multiple sketches, despite how difficult the requirement is for them. Students often just want to create a sketch and go with it, but they should be challenged to keep sketching and resketching the idea. Iterations often bring new and refined ideas when the designer keeps thinking through the design with a pencil in hand. Repeatedly drawing the same object with slight variations helps the designer consider multiple ways to shape the object. Figure 8 shows examples of the same object, in this case, various designs of a robot's armature. Encourage students to treat each drawing with equal attention to ensure each idea is represented fairly. In Figure 8 all the drawings on the left have been made with the same level of care so it is easier to compare the ideas based on their different merits. On the right however, the first sketch looks much cleaner. This can cause the idea to look more appealing (even if it is not the best idea) purely due to the fact that it has been sketched better than the others. Encourage students to keep refining a design idea and fill the page with various adaptations of the design. Many industrial design sketches on the internet demonstrate this approach to developing an idea. A technology teacher knows they are doing well when a student has explored their design on paper enough to know that it should NOT be built. Too many designs from students and professional designers alike should have remained in the sketch

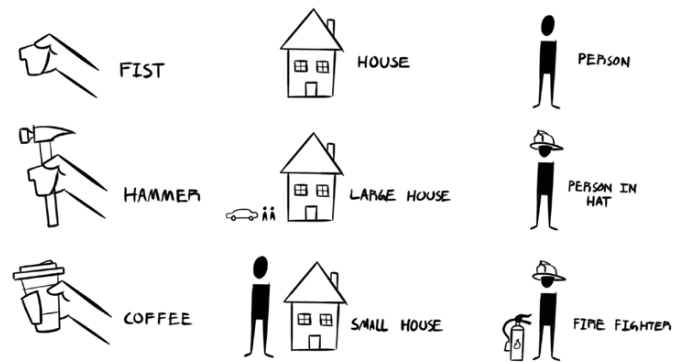


Figure 5.

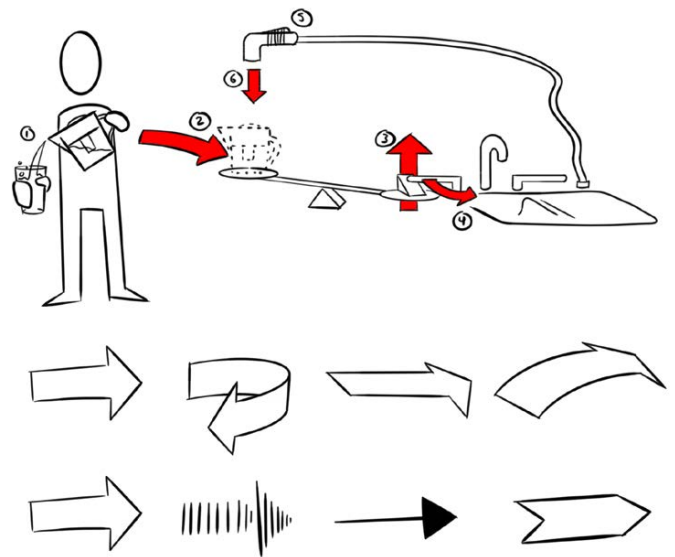


Figure 6.

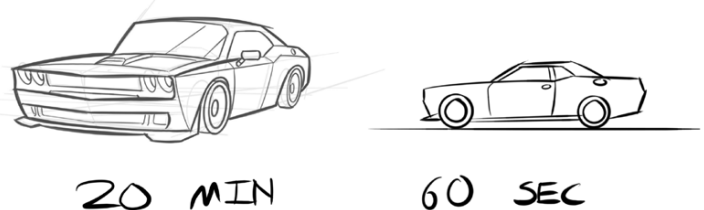


Figure 7. Quick vs Details

pad rather than being produced. Too often design ideas are not refined in the sketch space and it's not until the designer hits print and a 3D prototype appears and shows everyone it was a mistake.

Free Sketch Friday

Like any skill we teach students, sketching needs to be developed through practice. Too often, other assignments, tasks, and other skills become more important than sketching. However, using the techniques provided here might help your students improve their sketching skills. Additionally, teachers are encouraged to create opportunities for developing those sketching skills while students also have fun. Telestrations is a popular board game similar to the "telephone game" but with a small whiteboard on which students sketch and then pass to a partner who interprets. It's then passed on to the next peer to sketch again. This would be a great classroom exercise for a "Free Sketch Friday." The teacher might also use these opportunities to review student sketches that "blurred the story" to illustrate to the class how the student might have improved the sketch to better communicate the topic, movie title, or other game card category. Other fun sketching games are Fake Artist in NY, Pictionary, and Win, Lose, or Draw, or just make up a sketching game of your own. The next time you need a substitute teacher lesson plan, consider having students practice their sketching techniques.

Closing

It is the authors' hope that this article provides new techniques and sketching examples to help you and your students develop design ideas and allows their creative juices to flow freely. Students may lack confidence in creating design sketching and this insecurity can limit their design abilities. If design is at the core of technology and engineering technology and if you link to *Standards for Technological and Engineering Literacy* (ITEEA, 2020) in your classroom, then consider adding the sketching techniques presented here. You will be surprised at how sketching can improve your students' ability to solve problems, generate better design ideas, create better projects, and improve their technological and engineering literacy.

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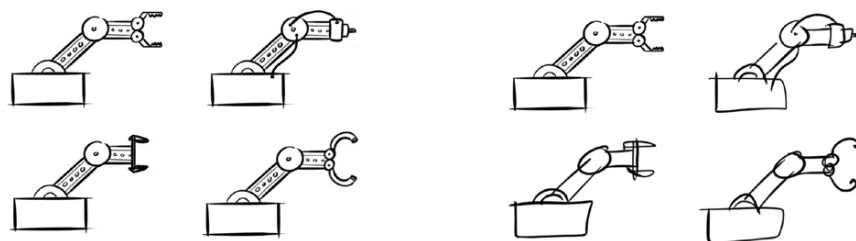
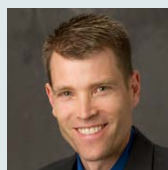


Figure 8. Iterations help refine design ideas

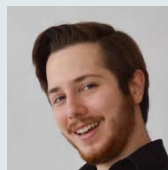
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