Sketchtivity is a powerful tool in engineering design. Sketching enables fast and dynamic communication between stakeholders (Goldschmidt, 2007), sketching allows designers to reason with design concepts (Goldschmidt, 1991), and sketching offloads designers’ working memory (Bilda & Gero, 2009). Sketching has been shown in a variety of contexts to improve outcomes (Yang, 2009). However, sketching education for engineers is still limited. Sketching is most effectively taught in studio-style classes where instructors provide one-on-one qualitative feedback for students. This time-intensive instruction is not possible in most entry-level engineering courses. Sketchtivity was developed to meet this need and make learning sketching more accessible.

Sketchtivity is an intelligent tutoring software designed to provide real-time feedback on sketching practice. The software offloads the qualitative feedback task of the instructor and provides precise guidance for improvement. Sketchtivity shows immediate feedback on precision in the form of red error bars displaying distance from ideal, and it gives summative feedback on key metrics for sketching: precision, smoothness, and speed.

The aims of this project are to understand the impact of Sketchtivity in the classroom and to better understand the benefits of improved sketching skill for engineering design. We are implementing Sketchtivity in classrooms, examining ways to improve the measurement of sketching skill, and looking at the relationship between sketching skill and idea generation.

Sketchtivity in the Classroom

Sketchtivity has been implemented in many courses at three diverse universities in the US. Hundreds if not thousands of students have had the opportunity to practice on the platform and hone their skills.

To understand the impacts of Sketchtivity, we compared students practicing on paper or the tutoring platform using a tablet. Practice on a tablet did not hinder skill development compared to paper, and more research is underway to understand how students are learning from the Sketchtivity platform.

Many engineering curriculums allot minimal time for sketching instruction and practice. Comparing across universities, we found that 3 weeks of classroom sketching instruction is too little to impact students’ skill development, but students showed significant improvement after 6 weeks (about 1/3 of a semester) of sketching instruction (Weaver, Ray, et al., 2022).

Improvements in Sketch Quality by Instruction Length

<table>
<thead>
<tr>
<th>Week</th>
<th>Sketch Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>1.8</td>
</tr>
<tr>
<td>Post</td>
<td>3.2</td>
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</tbody>
</table>

Real-World Design Problem

Sketched Design Solutions

Sketching Skill & Ideation Effectiveness

Engineering design involves a great deal of visuospatial reasoning. Often, the design process starts with putting pen to paper. Sketching enables the creation and evaluation of design ideas in real time. A designer’s skill with sketching could have an influence on how they explore design ideas. This study examines to what extent sketching skill influences ideation effectiveness. We tested undergraduate engineering students on independent measures of sketching skill and ideation ability before and after receiving sketching instruction. Preliminary analysis showed that students sketching skill is largely independent of their productivity (Weaver, Buck, et al. 2022).

References


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