

UNDERSTANDING ENGINEERING DESIGN FIXATION FOR K-12 EDUCATION

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Abstract

Design fixation is a distinct and established research topic at a post-secondary level which has shown that practitioners of engineering in any capacity (e.g., K-12 students, engineering students, college professors, or professional engineers) can experience fixation. Some research has shown that elementary and secondary students exhibit signs of design fixation while working on engineering design challenges (Luo, 2017; Mentzer et al., 2015). This research brief provides a definition of design fixation, describe fixation in the K-12 classroom, and suggest additional needed research.

Understanding and Defining Fixation

Luo (2017) defined design fixation at a K-12 level as a barrier to creating design solutions that could stem from an exposure to prior examples and experiences or from a lack of content knowledge. Fixation manifests in students' design solutions in three forms: stereotypical design solutions based on teenagers' culture and gender norms (Luo, 2017); a lack of diverse design solutions across different groups (McLellan & Nicholl, 2011); and the tendency for students to use their first design ideas along with reluctance or inability to generate alternative solutions (Mentzer et al., 2015). Schut et al. (2020) explored the phenomenon during the design iteration stage. They found that students were resistant to receive feedback on their proposed design solutions and unwilling to consider alternative ideas.

The cause of fixation is not well understood. Luo (2017) thinks that a lack of related content knowledge leads young students to rely on their lived knowledge and cultural capital to solve engineering problems; thus, their design solutions incorporate features common to their culture. Classroom expectations may also influence fixation. McLellan and Nicholl (2011) found that teachers' unconscious expectations of "the correct solution" resulted in fixation with students' designs.

Conclusion

As more students have opportunities to engage in engineering design challenges, teachers need to be aware of student design fixation and how to address it during activities. Mitigating fixation could be as simple as asking the students to reflect on their design decision and alternative designs or encouraging students to use iteration to consider additional solutions. Given the limited research, we should be cautious to draw any immediate conclusions on fixation. More studies are needed on how fixation impacts student learning, circumstances that promote and reduce fixation, and teaching strategies that help students consider multiple perspectives to solving a challenge.

References

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