

To tinker or not to tinker... that is the question: A study of problem solving within the context of digital fabrication

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Young people today are growing up in an increasingly digital world. The digital age in which we live requires the use of skills “that have real, applicable value in a rapidly advancing world” (Sheffield et al., 2017, p. 149). One of these skills that is particularly in demand by employers today is being able to solve problems in technology-rich environments. In fact, several authors (Siddiq et al., 2017, Dede, 2010; Griffin et al., 2012) claim that 21st century skills, such as problem solving, will become more essential to functioning well in a connected world. It is increasingly clear that STEM (science, technology, engineering, and mathematics) education contributes to the development of problem solving, however, the so-called traditional school does not seem to meet the need for the development of this skill. According to a study by the Program for the International Assessment of Adult Competencies (PIAAC, 2012), this skill remains relatively low among young people in Canada (Statistics Canada, 2013). The traditional school must evolve into a learning environment that better allows young people to develop the skills they will need to adapt to a society where technologies are constantly evolving. With the growing popularity of STEM learning environments such as Makerspaces, in New Brunswick (NB) and around the world, young people have the chance to develop their problem-solving skills while working projects that require digital fabrication. However, there is very little evidence to date explaining how young people solve problems in these environments.

After reviewing the literature on the subject, our observation is that many problem-solving models exist and some even address problem solving within technology rich environments; however, there seems to be an absence of theoretical models that specifically address how students solve problems while engaged in a process of digital fabrication. It is also our observation that most problem-solving models ignore the impact of tinkering as an approach to resolve problems. Tinkering can be defined as a kind of fabrication that emphasizes improvisation, exploration and iterative experimentation when faced with a problem or project (Resnick & Rosembaum, 2013). It must first be noted that this concept is particularly important today since, as Resnick and Rosenbaum (2013) point out, our world is changing rapidly, and we must adapt by finding more creative and innovative solutions to today's complex problems and to the new ones that will arise. However, our education system prefers to emphasize planning, analysis, and the development of targeted strategies to solve problems, instead of favoring a tinkering approach which advocates an approach rather focused on improvisation, exploration, and experimentation. This ensures that the traditional classroom favors young people who are good at planning, but it does not necessarily prepare for the real world where the unexpected often affects a given plan. Given the innovative nature of projects developed in the context of Makerspaces, we tend to think that tinkering has a role to play in the problem-solving process. However, in schools in New Brunswick, among others, the role of tinkering in the problem-solving process remains unclear.

Through a grounded theory approach conducted in Makerspaces of five New Brunswick schools, our contribution seeks to clarify how students solve problems in digital fabrication context of Makerspaces, as well as the place of tinkering in the problem-solving process within this context. Our contribution seeks to present a new model for problem solving during the process of digital fabrication. Thus, we hope that the school system will be better informed about tinkering as a way

solve problems and its educational potential. Our results also highlight the presence of various factors that can impact the role of tinkering in this process, as well as the STEM related activities observed in Makerspaces in which the need for problem solving can arise.

References

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