

An Exploration of Female Engagement and Collaboration: The Bricks and Bits Maker Project

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Abstract: This poster explores how learners engage in “maker” activities when collaborating and how participation can become more inclusive when framing activities in order to connect learners with children in their own community. We describe the first iteration of the Bricks and Bits project where undergraduate engineering students were challenged to re-design the toys of children. Bricks and Bits specifically reimagines making as a service learning project in order to increase the inclusion of female participants.

Introduction

The institutionalization of makerspaces in schools and universities can be seen as a positive step towards the democratization of the maker movement. However, it can also have a detrimental effect on some of the most distinctive features of the movement such as spontaneity, creativity or innovation (Dougherty, 2012). Practitioners need to transform their discourses to involve those people who have traditionally been left out of these activities. The underrepresentation of women, for example, is a typical characteristic of the maker movement and many STEM careers caused by the lack of more adequate programs to cater for the interests of non-traditional maker groups (Davies, 2018).

Increasing the number of women involved in STEM domains can boost the quality of research as diversity enables more creative work while reducing bias (Marginson et al., 2013). However, enrolling a large number of women is not enough to assure their full inclusion in a project. Effective learning design of makers projects must include a more specific framework to favor the exchange of ideas among participants and enhance their collaboration during the design process.

An equity-oriented mindset characterized by shared activity, creativity and imagination, and the acknowledgement of a wider definition of learning, intelligence and science can contribute to a broader participation of underrepresented communities in STEM domains (Vossoughi et al. 2013). There have been different approaches to address the exclusion of women and other underrepresented groups in the maker movement by engaging them in gender-specific groups or implementing new fabrication tools (e.g. Kafai, Fields, & Searle, 2014). In this study, we conceive making as a purposeful activity, in which people can face meaningful challenges and raise awareness of their potential to respond to the needs of society (Unterfrauner & Voigt, 2017). By framing maker activities as activities that can connect participants with their communities and its circumstances, the participation of women can be broadened (Holbert, 2016).

Current project

The maker project presented in this paper, Bricks and Bits, follows a project-based service learning (PBSL) approach to learning as it attempts to align the purpose of the project (engage learners in an inclusive environment to construct objects) with the development of a fruitful relationship with the wider community. Bricks and Bits engages participants to re-design a toy for children aged 6-7 based on the characteristics of the toy and the outcomes of an initial interview following a design thinking methodology (Brown and Katz, 2009). This transforms a typical tinkering project, such as building a toy, into a project in which all participants must consider the needs and values of a child, the constraints of the toy that is provided, and find balance between the child's expectations and the students' limitations and possibilities.

In this poster, we explore how female makers in activities framed to connect with the learners' community make positive contributions during the initial phases of the design process but take a more secondary role when dealing with primary features of the design process. Our analysis suggests that there was a significant enrollment of women whose participation influenced positive collaboration for all participants. We also suggest that women in this study tended to be excluded from decisions regarding primary features of the final design.

Initial findings and discussion

Of the 35 students who participated in Bricks and Bits, 63% (22 out of 35) were male, and 37.1% (13 out of 35) were female. While the numbers are still not balanced, the participation of women is still higher than in

Engineering programs in Uruguay where women constituted only a 26.2% of students in 2017. This difference is even more dramatic when compared to the regional stats of this university where female participation in engineering programs is 6.25% (Ministerio de Educación y Cultura, 2017). This increase in female participation can be connected with the nature of the project, which rather than promoting the program as a space for tinkering and experimentation with robots or microcontrollers, was introduced as a Toy Factory for children in the community.

Despite the positive outcomes in terms of female students' own perception of their participation, it is evident that within this design process, female participants had few opportunities to contribute in the most distinctive features of the design. The analysis of the interactions shows that as each team progressed from the planning phase towards the prototyping and testing phase, the interactions of women decreased significantly.

It can be argued that the fact that female participants had less experience with fabrication tools could have hindered their participation. We believe, however, that a better design of the initial interview and the actions to be carried out immediately after, could prevent participants from jumping into conclusions too early in the process providing those with less experience in fabrication with more time to develop their own ideas.

Despite these challenges, women who took control of the aesthetic features of the toys, such as painting, decorating, sewing, or printing accessories with a 3D printer, felt they had made a positive impact on the final product taking their share of ownership of the final design. Another positive outcome of this design process is that 100% of the women (13 out of 13) claimed they would participate again in the project and that they would also like to be trained in the use of fabrication tools, more specifically 3D printing and e-textiles. Considering that the majority of the female participants did not mention "making" as a reason to join this program, this new interest in fabrication can turn into a positive entry point to engage female participants in maker projects. Female participants also showed great ability to work with people from different teams and benefit from their talents. This collaborative attitude among teams was mostly fostered by female participants and ended up making the whole design experience a more enjoyable one for all participants.

We offer the first iteration the Bricks and Bits project as an initial exploration for framing making activities as service learning projects in order to increase the inclusion of female participants. The high number of female participants who spontaneously signed up for this program encourage us to continue looking for evidence of the impact this framing can have on other similar contexts.

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