Rapturousness in makerspaces: Delight in construction

[1]Olga Fellus, [2]Viktor Freiman, [2]Olivia Lurette
[1]University of Ottawa, [2]Université de Moncton

Young children frequently and naturally engage in building structures and making other objects. As they are immersed in these activities, we call attention to the multiple manifestations of mathematical conceptions that are emerging form children's imagination and are being harnessed for the purpose of completing the task at hand. Teachers by default have always been pushed to notice their students' mathematical thinking and to surface evidence for mathematical engagement. However, what mathematical conceptions are manifested in young children's daily activities of play and building structures and how socio-emotional aspects such as rapturousness are occasioned in creative work have been under-researched and undertheorized.

Our presentation pursues investigation of school makerspaces in connection to STEM education (e. g. Freiman & Robichaud, 2018; Freiman and Kamba, 2020; LeBlanc et al., 2022, in press). The focus of this presentation will be on the socio-emotional aspects associated with work of creation as they are manifested in a group of kindergarten students building shelters for their stuffed animals. The children were tasked with picking up a stuffed animal and constructing a solid, yet mobile, shelter that will protect their animal from wind (hair dryer) and rain (water spray). During the stages of designing, planning, and building the structures, we witnessed not only the children's construction efforts of different spatial 3D configurations but also their sheer sense of rapturousness.

We followed the children's work as it gradually took shape as a product of their imagination and intuitive representations. We captured the young children's ingenuity and strong involvement in the process of decision making about the geometrical shape that would hold their structure solid and about its size through measurement and estimation. We also documented their sequence of actions that would guarantee a robust structure, and their coordination and synchronization of embodied spatial interaction that would allow for efficient and effective collaboration and cooperation.

Within this context, as the young children were carrying out actions of classification, rotation, orientation, synchronization, folding, changing the shapes of the building materials, and using units of measurement through gesture, we captured expressions of emotions and social interactions that seem to reveal several markers of eagerness and rapturousness through dynamic movements, gestures, and facial expressions.

These were extensions of, or perhaps prerequisites for the young children's intuitive ability to construct appropriate structures for their respective stuffed animals and by doing so also to make visible their innate mathematical behaviour in space. The demonstration of multiple combined ways of solving challenges using mathematical conceptions led to our deep appreciation of the children's new structures. We detected the children's expressions of high emotional engagement as they were working without a clearly prescribed procedure thus exercising autonomy. For example, two students coordinated their movements to cut out parallel sides of a wall for their shelter while keeping the lines straight and perpendicular to the base. In another example, a student

was focusing on the orientation of the piece of carton that they were holding to place a "roof" for their shelter in order to protect their animal from the "rain." Several other examples from our data will nurture discussion of the role of such 'intensive' moments of knowledge building on the development of rich mathematical connections.

References

Freiman, V., & Kamba, J. (2020). 3D Modeling and Printing to Support Students' STEM Explorations in School Makerspaces: Lessons from one Case Study from New Brunswick, Canada. pp. 96-110). In: A. Savard and R. Pierce (Eds). MACAS in the Digital Era: Proceedings of the 2019 MACAS Symposium, Montreal, Quebec, McGill Faculty of Education.

Freiman, V., & Robichaud, X. (2019). Fostering young children's creative minds: Kindergarten kids explore school-based STEM lab. Mathematical Creativity and Giftedness International Conference, Hamburg, August, 2019. https://www.mcg2019.de/en/presentations/#1563962186961-45d39a82-60dd

LeBlanc, M., Freiman, F., & Furlong, C. (in press). From STEm to STEM: Learning from students working in school makerspaces. In *Mathematics and its Connections to the Arts and Sciences (MACAS): 15 years of Interdisciplinary Mathematics Education*. Springer.