

Crystallography in Kindergarten [1]

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Friederich Froebel, a nineteenth century educator trained as a crystallographer, invented Kindergarten. Froebel's background in crystallography infused every aspect of his conception of Kindergarten, especially the self-actuated learning devices or "gifts" that were the center pieces of his curriculum. Froebel kindergartens spread rapidly through Europe, the United States and Japan in the latter half of the nineteenth century. Crystal engineering was thus a primary occupation of millions of children in the first several kindergarten generations. The kindergarten-crystallography connection was first established by Jeanne Rubin [2], a professor of music, and was later expounded on by Norman Brosterman [2], an architect. However, the importance of crystallography in the early childhood education is virtually unknown among crystallographers. Here, we review the remarkable life of Froebel, his crystallographic worldview, and his influential invention. We further discuss how Froebel kindergartens influenced modern art and speculate on how they influenced the course of modern science, especially X-ray crystallography.

[1] B. Kahr, *Cryst. Growth Des.* **2004**, 4, 3-9.

[2] Rubin, J. S. *Intimate Triangle: Architecture of Crystals, Frank Lloyd Wright and the Froebel Kindergarten*, Polycrystal Book Service, Huntsville, Alabama, 2003. <http://www.polycbs.com/flier.jpg>

[3] Brosterman, N. *Inventing Kindergarten*, Harry N. Abrams, New York, 2002.