CONNECTING ARITHMETIC AND GEOMETRY AS AN ARTISTIC EXPERSSION OF COLLATERAL CREATIVITY

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The goal of this proposal for a paper presentation is to discuss the notion of collateral creativity in the context of instrumental integration of symbolic and visual mathematics as a creative art. Collateral creativity is defined by the authors (Abramovich & Freiman, 2021) as an accidental but favorable outcome of K-12 students and their future teachers touching upon hidden ideas of mathematics through technologically supported pedagogic mediation. The concept of instrumental act was introduced by Vygotsky (1930) to highlight possible uses of tools as means of reconstruction of the whole structure of one's behavior in the process of problem solving. Finally, the idea of mathematics as a creative art was most notably discussed by Halmos (1968) who, in particular, saw mathematics and painting as both having origins in "physical reality" (p. 388).

Number theory, with its origin in symbolic description of images found in real life, includes problems dealing with additive decomposition of integers. Over the centuries, the development of mathematical knowledge evolved by describing the properties of geometric shapes in a symbolic form. For example, the number 25 can be decomposed in the first five odd numbers (alternatively, the corresponding square can be split in five gnomons), in two consecutive triangular numbers (making a square from two equilateral triangles), and in the sum of two squares (connecting squares built on the sides of a right triangle). In the classroom, all those connections between symbols and images can be instrumentally presented by using manipulatives as well as digital tools. In the authors' experience, such artistic presentations of mathematical ideas motivate students to ask collaterally creative questions. In the specific context of decomposition of numbers and corresponding images, the importance of the center of a square emerges and the task of partitioning square into equal parts sharing the center can be formulated and explored. The paper will show a simple algorithm of partitioning a square into any number of equal parts sharing the center leading to various aesthetic images.

Another artistic exploration considered in this proposal deals with finding the number of regions into which a square can be divided by connecting specific points belonging to its sides (including vertexes) that were used in partitioning a square into equal parts. This task not only brings learners back to numbers which can be found in the Online Encyclopedia of Integer Sequences but it leads to a classic domain of mathematical knowledge known as Four Color Problem (Appel and Haken, 1977). The authors argue that collateral creativity while being an accidental outcome of classroom activities is nonetheless a favorable one as finding answers to collaterally creative questions leads to epistemic development of both more and less knowledgeable practitioners of mathematics education.

References

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