
MATHEMATICAL EDUCATIONAL NOTES

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GEOMETRY IN THE FIRST GRADE

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In the spring of 1958 we spent two and a half months in an experiment which involved teaching geometrical notions and constructions to the entire class of first grade students at Stanford Elementary School (a public school in the Palo Alto Unified School District). After a few informal talks we began a systematic development of a modified version of Book I of Euclid's *Elements*.

Our approach was to stimulate reasoning among the pupils, although no formal proofs were attempted. The propositions from Euclid which were stressed were the constructions. In each case the construction (*e.g.*, bisecting a line segment) was presented as an open problem, and the students were encouraged to attempt solutions. As much as possible we forced the children to give the reasons for rejecting an incorrect solution. Generally speaking, our pedagogical procedure closely resembled that of Socrates' interrogation of the slave in Plato's dialogue *Meno*. It is worth noting that at no point did we rely on any knowledge of arithmetic. As a consequence our program is completely independent of the standard curriculum in elementary school mathematics.

Our main modification of Euclid was to use the compasses as rigid instruments to make direct comparisons of distances. We thereby trivialized Propositions 2 and 3 of Book I.

An encouraging aspect of the experiment was the unexpected ability of the students to assimilate the technical vocabulary. Printed worksheets were distributed every other day, and the students were asked to read aloud the written formulation of the problems. The technical terms introduced were then added to the regular reading vocabulary lists ordinarily presented in the first grade. Precision of expression was improved by daily drill and continual repetition of fundamentals. Each school day one of us met with the students for a period of from fifteen to thirty minutes.

It is our conclusion that the actual physical use by each pupil of straight edge and compass played an integral part in the progress of his understanding of geometrical constructions. This physical activity, which had direct mathematical meaning, seems to us somewhat superior to the conventional physical manipulation of objects used to illustrate arithmetic.

Certain problems arose due to disparities in the abilities of the students, but these disparities were no more striking than those encountered by the regular teacher in the standard reading program.

On the basis of the encouraging results of this experiment, we are continuing work along these lines, and are also exploring possibilities in other primary grades.