First name :
Michiel
Last name :
Doorman
Personal title :
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Affiliation :
Utrecht University
Preliminary title :
The emergence of meaningful geometry in the Netherlands during the 20th century
Abstract :
Geometry education in the Netherlands reformed during the last century. This was not a reform movement on its own. Worldwide mathematicians and mathematics educators came with new ideas as an alternative for the traditional axiomatic approach to teaching geometry. Already at the end of the 19th century Klein made a start with it by advocating a transformation geometry, but in this approach the axiomatic structure still played a main role for ordering the activities. This was not the case in the work of Fröbel and Montessori who by building on students' intuitions and their attention for students' development of spatial insight were important driving forces towards a meaningful approach to geometry education. In the Netherlands, the pioneers of such a geometry were Tatyana Ehrenfest and Dieke van Hiele-Geldof. Freudenthal was a great promoter of their ideas. For him, geometry is 'grasping space', meaning that geometrical experiences should start with the observation of phenomena in reality. Supported by Freudenthal, from the 1970s on, experiments were carried out in the Netherlands to develop a new intuitive and meaningful approach to geometry education, in which the focus was on spatial orientation. How big the change was in geometry education that resulted from these experiments is illustrated by comparing geometry problems from two Dutch mathematics textbooks: one from 1976 and one from 2002. Characteristic of the reformed approach is that students are introduced to the world of geometry (the language, the objects and the constructions) by providing them with tasks in 3D contexts that can elicit their intuitive geometrical reasoning. Starting geometry education by developing spatial intuition and 'grasping space' was very much supported by Freudenthal (1973) and is exactly at the heart of the ideal of Ehrenfest-Afanassjewa (1931). The result of this reform is that in Netherlands geometry education nowadays mostly starts with an intuitive introduction, after which it continues in a context-rich course for 12 to 16-year olds, ending in reflections on definitions and axioms, i.e. geometry as a deductive system, for a selected group of students by the end of secondary school. Ehrenfest-Afanassjewa, T. (1931). Übungensammlung zu einer Geometrischen Propädeuse [Collection of exercises for a foundation course in geometry]. Den Haag, the Netherlands: Nijhoff. Freudenthal, H. (1971). Geometry between the devil and the deep sea. Educational Studies in Mathematics, 3(3-4), 413-435. Fröbel, F. (1826). Die Menschenerziehung [On the education of man]. Keilhau/Leipzig, Germany: Wienbrach. Goddijn, A., Kindt, M., & Reuter, W. (2014). Geometry with applications and proofs. Rotterdam, Boston, Taipei: Sense Publishers. Troelstra, R., Habermann, A. N., De Groot, A. J., & Bulens, J. (1962). Transformatiemeetkunde. Deel 1, 2 en 3 [Transformation geometry. Part 1, 2 and 3]. Groningen, the Netherlands: J.B. Wolters. Van der Eijk, E., Van der Horst, A., Koning, A., Kok, D., & Schaberg, G. (2002). Moderne wiskunde 1a HAVO/VWO [Modern mathematics 1a HAVO/VWO]. Groningen, the Netherlands: Wolters-Noordhoff. Van Hiele-Geldof, D. (1957). De didaktiek van de meetkunde in de eerste klas van het V.H.M.0 [The didactics of

geometry in the first year in the lowest level of secondary vocational education]. Unpublished thesis, University of Utrecht, the Netherlands.