Scientific novelties implemented into teaching mathematics in secondary schools on the Polish territories in the 19th century. The case of the Karl Koppe's theorem on the volume of obelisks

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Research on the history of mathematics and the history of mathematics education allow us to identify certain scientific issues that were quickly implemented in secondary education. An example of one of the fastest transmissions of this type in Poland was the theorem on calculation of the volume of solids which bases are two parallel polygons and lateral faces are trapeziums, formulated and proved in 1838 by Karl Koppe ([1]).

About half a year after that, Koppe made a request to Berlin to call the solid with the above-mentioned properties an obelisk. The name of the obelisk was approved, and the Ministry required him to provide the proof of the theorem on the volume of obelisks in a manner elementary enough to be implemented in secondary schools. Koppe finished this task in 1843 and described the results in [2], as well as in school textbooks that he published later – they were used in most real schools and in selected gymnasia on the Polish territories under Prussian rule. So, in this case, the transmission of scientific novelty to school teaching took only 5 years.

Koppe's theorem turns out to be quite controversial because in the opinion of some contemporary historians of mathematics it is false. This became the motivation for the preparation of this paper, in which Koppe's results will be thoroughly analyzed, including: recreating the definition of a polygon and polyhedron used by the author, discussing the proof of the theorem, presenting considerations made by Koppe on the background of the then level of knowledge, and analyzing the way of adjusting the 1838 results to the skills of secondary school students.

It will be shown, e.g., that Koppe used on the definition of an oriented polygon introduced by Meister, and some other results introduced by Hirsch and Möbius, moreover like all his contemporaries, he believed that each polyhedron is orientable, although none of this information was given directly by him. It will also be indicated that the Koppe's adaptation of this scientific novelty to secondary school students in some cases was incorrect.

Nowadays, Koppe's theorem isn't discussed in secondary schools – an attempt will be made to explain why it was removed from the curricula.

Selected literature:

Hirsch M., *Sammlung geometrischer Aufgaben*, vol. 1. Berlin, 1805.

Koppe C., *Ein polyedrischer Satz*, "Journal für die reine und angewandte Mathematik" 1838, vol. 18, no 3. ([1])

Koppe K., *Anfangsgründe der reinen Mathematik für der Schul- und Selbst-Unterricht*, vol. 3: Stereometrie. Essen, 1867.

Koppe K., *Ein neuer Lehrsatz der Stereometrie – Eine Beilage zu allen stereometrischen Lehrbüchern*. Essen, 1843. ([2])

Meister A.L.F., *Generalia de genesi figurarum planarum et inde pendentibus earum affectionibus*, „Novi Commentarii Societatis Regiae Scientiarum Gottingensis" 1769/70, vol. 1, pp. 144-180.

Möbius A.F., *Der barycentrische Calcul ein neues Hülfsmittel zur analytischen Behandlung der Geometrie…* In: *Gesammelte Werke*, vol. 1. Leipzig, 1885.