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Relevance of mathematics journals for Dutch teachers in the 18th and 19th century

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Mathematics teaching took place long before the formation of teacher education institutes and university courses for mathematics teachers. Very little is known about the ways teachers acquired the necessary knowledge and skills before the mid-19th century. In the Netherlands, from the late 16th century on, a tendency is noticeable to have all children taught reading, writing and increasingly often some arithmetic. Moreover, as was the case in England, there was an expanding group of mathematical practitioners who needed some knowledge of the relevant mathematics. Consequently there were many small schools with lowly paid primary teachers, and there were many private mathematics teachers and small private schools where some mathematics was taught. In the 18th and 19th century many journals were published in the Netherlands, including mathematics journals for teachers. In this paper the relevance of such journals for teachers' improvement of their mathematical skills and position in society is discussed.

History of mathematics education, mathematics journals for teachers, primary schools, teacher examinations.

Introduction

In the process of teaching and learning mathematics, the mathematics teacher is an important actor; consequently his/her skills, Mathematical Content Knowledge (MCK) and Pedagogical Content Knowledge (PCK) are the subject of a body of research. Analysis of three historical Dutch cases of mathematics education shows, that already in 1600 the relevant mathematical knowledge and pedagogical qualities of the mathematics teacher were considered very important for the successful implementation of mathematics curricula (Krüger & van Maanen, 2013; Krüger, 2014, pp. 463-474). The question arises how mathematics teachers in the past acquired the necessary knowledge and skills to be successful. Recent research on this topic is often concerned with the present educational structures, restricting itself to the late 19th and the 20th century, e.g. (Candeias, 2017; Menghini, 2017). However, in Europe as elsewhere, mathematics was taught for centuries before the creation of the present stable educational structures, with its formal teacher education institutes. The Netherlands form a rich case for several reasons:

- Starting in the late 16th century, a drive to teach all children reading, writing and gradually also some arithmetic, in combination with a complete absence of central regulation of education, until 1806. There were no teacher training institutes until the 19th century, very few until the 20th century.
- A relatively high demand for mathematics teaching, due to the growing number of mathematical practitioners (navigators, geometers, wine gaugers, engineers, etc.), who one way or another, had to learn the relevant type of mathematics.
- An abundance of publishers of journals, from the late 17th century onwards. Many printers and editors were active in the Netherlands, not only in the larger cities, but also in the smaller towns.

Thus journals, relatively low priced and flexible, could play a role in the dispersal of knowledge for teachers. The first mathematics journal for teachers was published in 1754, probably the first journal for this specific group in Europe (Gispert, 2018). On the topic of mathematics journals for teachers, recent publications mainly concern the second half of the 19th century or later, when teacher education institutes were established, e.g. (Furinghetti, 2009; Oller-Marcén, 2017). Preveraud (2015) published a paper on mathematical journals, published during the first half of the 19th century in the USA and instrumental in the transmission of French mathematical education to American higher and secondary education. The present paper concerns mathematics journals for teachers in primary and advanced primary education, in the 18th and early 19th century. Secondary education was not formally part of the educational system until 1863 (Boekholt & De Booy, 1987; Krüger, 2014).

The number of mathematical journals aimed at teachers increased during the first half of the 19th century. With regards to the question “How did Dutch teachers of mathematics acquire their knowledge before there was formal teacher education?” the focal question of this paper narrows to “*Which role did mathematics journals have in the acquisition of knowledge by Dutch teachers in the 18th and early 19th century?*”

The main method of research is analysis of a limited number of journals from the period (1754-1835), with regards to the occupation of the subscribers, the topics treated and the style of treatment. These journals are included in the database of Cirmath¹.

Mathematics: a boost for the teacher’s career, 1750-1800

In the 18th century nearly every village and each town in the Netherlands had at least one primary school, a so-called ‘Dutch’ school, supervised by the local council and the local reformed church, in which children could learn the catechism, reading, writing, and usually arithmetic. There were also many private schools with often more advanced primary education, with a few more mathematical subjects, so-called ‘French’ schools, and there were private schools for specialized mathematical instruction. Subjects taught in these small mathematics schools depended on the specialization of the instructor: algebra, geometry, geography, surveying, navigation, bookkeeping, fortification, astronomy, architecture, etc..

Being knowledgeable in mathematics had several advantages for teachers in primary schools: improved results in the comparative exams for the better paid teaching posts, the possibility to give private lessons to students or to start a French school or even a specialized mathematics school and thus to improve one’s income in several ways (Krüger, 2018, 2). One could also combine working as a mathematical practitioner with teaching. Most aspiring teachers lacked the financial means and the required knowledge of Latin to study at a university. So their main means to learn mathematics were private lessons and self-instruction.

A teacher at a Dutch school usually had a very low salary, supplemented by the fees parents paid for each subject or part of subject taught to their child, by chores for the church and other jobs, e.g. gravedigger. As parents were encouraged, but not obliged, to send their children to school, the

¹ *Circulation des mathématiques dans et par les journaux*: <https://cirmath.hypotheses.org/>

income varied through the year, with in rural areas a severely diminished income in the summer months. In the more expensive French schools the pupils were also taught French and other subjects, such as advanced arithmetic, bookkeeping, geometry, algebra, geography and drawing and the fees were paid for longer periods. A consequence of the lack of a national curriculum and of national teacher qualifications was a large variation with regards to the level and quality of instruction between the various Dutch schools and also between French schools.

The teachers and their journal

Working as an assistant-teacher was the usual way to start a teaching career. When there was a vacancy in a Dutch school, local councils usually required a comparative examination, in writing, reading from the Bible, singing hymns and increasingly often in mathematics. Mostly arithmetic, but by the mid-eighteenth century in the western part of the country there were also exams covering several mathematical subjects (Krüger, 2018). Those exams were often set by a teacher, either the departing teacher or from a school in the vicinity. Examples of such examinations, with different levels of mathematics (*Mathematische Liefhebberye*, 1754, 1755):

- On 24 November 1754 in Lopiker-Kapel, a small village in the province of Utrecht (in the middle of the country), the exam consisted only of reading from the Bible and singing a hymn. It was not a well paid position, only assistant-teachers applied.
- On 8 December 1754 in Oost-Zaan, a small town in Holland, near Amsterdam, 4 teachers took part in the examination, which included ten arithmetic problems.
- In 1751 in Purmerend, a slightly more important town in the same area as Oost-Zaan, a new town's schoolmaster and cantor was appointed after a strenuous exam, consisting of fourteen questions on arithmetic, twelve questions from geometry (plane and solid), ten problems on navigation and six problems on spherical trigonometry.

From 1754-1769 Pieter Jordaan, librarian in Purmerend, published the first Dutch mathematics journal for teachers, a monthly with news of primary schools (vacancies, examinations, etc.) and a section on mathematics, *Mathematische Liefhebberye* [Mathematical Pastimes]. Each month mathematical problems, from the editor and the readers, were published, as were solutions to problems published in previous months, also from the readers, sometimes discussed by the editor. The mathematics editor until 1765 was Jacob Oostwoud, teacher in Oost-Zaandam, surveyor, mapmaker and author; he was succeeded by Louis Schut, also a teacher. A specific goal of the editors was support for teachers who were inexperienced in mathematics, by more experienced teachers and practitioners. In total 3000 problems were published, apart from the questions of the local examinations for teaching posts, also published frequently. There was some theory, on topics such as arithmetic theorems, series and probability. More than 100 subscribers, amongst whom a few women, were active in sending questions and even more sent solutions. The problems mainly came from existing publications, recent ones, but often from the 17th century as well. German authors were a favourite source; later on English journals were mentioned as origin of some problems. Over the years a wide range of topics was addressed, arithmetic and algebra, but also geometry (calculations and constructions), both plane and solid geometry, simple problems in probability, navigation problems (spherical trigonometry) and maximum-minimum problems, solved by means of a new technique, differentiation. Obviously arithmetic and algebra were important subjects for all teachers, and there is a large range of topics which may be put under these

headings. Simple questions, for beginners, modelling of a situation, resulting in equations or systems of equations from linear up to the fifth power, series, proportionality, also in mechanics, mixtures of substances, distances travelled (Krüger, 2018).

The journal may be seen as an example of informal teacher training, by experienced teachers and practitioners. It gives the impression of eagerness and a combination of learning and recreation. The journal offered problems from elementary mathematics to fairly advanced mathematics and the editors positively encouraged readers at all levels to join in.

Mathematics: obligatory for primary teachers

From 1795, with the proclamation of the 'Bataafse Republiek' [Batavian Republic], a process of centralization was set off, also for education. The first Dutch constitution (1798) mentioned 'national education', there was mention of responsibility of the national government for education and in 1806 the first national law on primary education was accepted. The law and its regulations specified amongst many other matters the subjects which had to be taught (reading, writing, arithmetic and Dutch language), the required content knowledge for primary teachers and the obligation to pass an examination, also in mathematics, as a prerequisite for a teaching post. Primary school teacher was on its way to become a profession.

The teaching certificate recognized four ranks of male teachers; there was only one rank for women. For the lowest rank (4) one had to show reasonable skills in reading, writing and basic arithmetic, with whole numbers up to and including simple proportions (rule of three). For the third rank the candidate had to show for mathematics also skills in calculations with fractions and in use of calculations in problems from daily life. For the second rank the candidate should also have theoretical knowledge of arithmetic; for the first and highest rank, one had to show proficiency in mathematics and science, amongst other things. For each rank there were other requirements as well, for example level of teaching skills, knowledge of geography, etc. The mathematics exam always had a section on theory and practice of arithmetic, in whole numbers, fractions and decimal fractions and problems pertaining to daily life (for rank 1-3). As an addition one could take exams in specialist subjects, such as languages or advanced mathematics. The primary schools were ranked as well, with the salary in accordance to the rank of the school. A teaching rank 1 or 2 gave the right to be appointed at the highest ranked and best paid schools. So any primary teacher with ambition tried to reach at least second rank. The first rank was rather sparingly handed out by the regional examiners (Boekholt & de Booy, 1987, pp.109-110).

So this law put in place formal requirements on a national level for primary teachers, male and female, in order to improve education for all children. The teachers would get payment from the council and classroom teaching to groups of similar abilities was introduced. Regional school inspectors, appointed by the national government, would see to enforcement of legislation; they encouraged modern teaching methods and actively strove to improve the quality of teachers. However, it took a long time before the changes became reality in all parts of the country.

Secondary education continued to be privately organised with French schools and specialist schools. Latin schools, also called gymnasia, where mainly the classics were taught as a preparation for university, were from 1826 obliged to provide instruction in mathematics, following at least a minimal curriculum (Smid, 1997). At some gymnasia a primary teacher of first rank was engaged to

teach mathematics, as often the professors at the Latin schools looked down on mathematics and/or didn't know enough to teach the subject.

The teachers and their journals

In order to become a teacher in primary education, the usual way still was to find a teacher with whom one could work as an apprentice, while in the evenings studying for the examinations. The assistant-teacher was now called 'kwekeling' or 'secondant'. To improve the content knowledge and pedagogical knowledge of primary school teachers, the government promoted the formation of local teacher societies [onderwijzers gezelschappen], whose members were inexperienced teachers as well as experienced teachers and school directors. They had regularly meetings to discuss the subjects and teaching methods (Boekholt & de Booy, 1987, p.111) and practiced for the teacher's exams. The teacher societies started small libraries, with textbooks and journals. Mathematics journals, which had as explicit aims improving the mathematical and pedagogical knowledge of teachers in primary and advanced education, were published from the 1820's. They can be classified into four categories: journals on general mathematics; on arithmetic; on arithmetic, algebra and geometry; on mathematics and sciences. Only the first three categories will be discussed in this paper (Table 1).

Table 1: Dutch mathematics journals for teachers, 1820–1850

<i>Tijdschrift ter Bevordering der Mathematische Wetenschappen (TBMW)</i> [Journal for the Improvement of Mathematical Sciences]	1823–1828
<i>Magazijn voor de rekenkunst (MR)</i> [Magazine for the arithmetic art]	1828–1835
<i>Bijdragen tot de beoefening der zuivere wiskunde (BBZW)</i> [Contributions to the practice of pure mathematics]	1829–1833
<i>Magazijn voor stel- en meetkunst (MSM)</i> [Magazine for algebra and geometry]	1830–1835
<i>Bijdragen tot de beoefening der gewone cijferkunst (BBGC)</i> [Contributions for the practice of simple arithmetic]	1831–1840
<i>Tijdschrift voor reken-, stel- en meetkunst (TRSM)</i> [Journal for arithmetic, algebra and geometry]	1839–1842
<i>Nieuw tijdschrift voor reken-, stel- en meetkunst (NTRSM)</i> [New journal for arithmetic, algebra and geometry]	1843–1847
<i>Tijdschrift der toegepaste rekenkunst voor onderwijzers en gevorderde leerlingen (TTR)</i> [Journal of applied arithmetic for teachers and advanced pupils]	1850–1852

These journals existed usually between four and ten years; often with a change of editor(s) a journal got a new or slightly different name and so became a new but very similar journal as its predecessor. For example one of the first journals in the 19th century with many teachers among its subscribers, was the Journal for the Promotion of Mathematical Sciences, or TBMW for short², on general mathematics. It was published by J.P. Bromstring in Purmerend; the editor was Jacob (Jan)

² In this paper the abbreviations, introduced in Table 1, will be used, to save space.

van Cleeff, mathematics teacher at the Academy for Drawing, Architecture and Navigation in Groningen (Beckers, 2003, p.77). In 1823 there were 250 subscribers listed. In the last volume the readers were informed that Mr van Cleeff had decided to discontinue as an editor, due to his workload, however there would be a new journal with Hendrik Strootman, subscriber and contributor to TBMW, as editor. This new journal was BBZW, also on general mathematics; the number of subscribers had increased to about 420. Hendrik Strootman taught mathematics at the Royal Military Academy, since 1828 situated in Breda. From 1830 this journal was published in Breda. Another example is the succession of TRSM by NTRSM. The editors are unknown, but the publisher and format were the same for both journals.

All journals in Table 1 were quarterlies; they all published problems and their solutions, usually also other forms of content, such as articles and reviews of books and they encouraged subscribers to send solutions and new problems. The subscribers, usually listed in the first volume, are differentiated in four categories: educators (teachers, assistant-teachers, mathematics teachers, teacher societies and school inspectors), other occupations, including military, no occupation mentioned and booksellers. The two journals on general mathematics, TBMW and BBZW, treated similar topics as are found in the 18th century journal for teachers. However, in the 18th century the journal was aimed at teachers (and other practitioners) who were also ‘lovers of mathematics’; presenting mathematics as both useful and a pleasant pastime was usual in the 18th century in the Netherlands. This attitude shows in the interactions with the readers, which is lively and frequent. In the 19th century mathematics was less seen as a pastime, it was, for teachers, military and other practitioners, a serious requirement for their profession. All teachers had to learn at least some mathematics, whether they liked it or not, and the more the better from the point of view of career. The style of the journals was modern; the solutions of problems were clear and well formulated, the theoretical articles, if present, were usually well written. If sources were mentioned by the editors, they were from recent authors, such as De Gelder, Lacroix, Floryn and Prinsen, who were comfortable with the new, more exact style of mathematics and with modern teaching methods.

Another difference was the absence of women. In 18th century journals on mathematics most subscribers were males, but there were a few subscribers recognisable as women who occasionally sent problems and also solutions. Though the law on primary education stated that ‘primary education is taught by teachers of both genders’³, the lists of subscribers was invariably titled: ‘the gentlemen subscribers’. Mathematics was by now a very serious and consequently male business, women who wished to subscribe may have done so through a bookseller, remaining invisible.

Between 40% and 50% of subscriptions was ordered by booksellers, it is as yet not clear why so many ordered their copy through a bookseller. Of the personal subscriptions TBMW and TRSM both had around 70% working in education. TBMW aimed at practitioners and teachers, TRSM aimed at inexperienced and experienced teachers of Dutch and French primary schools. For the other journals this percentage was between 44% and 61%. It is remarkable that for all journals, irrespective whether they aimed specifically at teachers, up to 16% of the personal subscriptions was taken by other professionals (military, skippers, farmers, bookkeepers, shopkeepers, notaries,

³ Reglement voor het Lager Schoolwezen en Onderwijs binnen de Bataafsche Republiek 1806, art. 4

etc.). The first journal on arithmetic only (MR) was very popular. It was meant for student-teachers and advanced pupils in primary schools, as was BBGC. The journals on algebra and geometry, MSM, TRSM, NTRSM, were aimed at the teachers of French schools and the advanced classes of Dutch schools, with older pupils. They also served the teachers who studied for a higher certificate. Evidently, even if there was some specialization among the journals for teachers of primary schools. TTR was slightly different: it was meant for 'teachers, advanced pupils, farmers, builders, stonemasons, carpenters, painters, shipbuilders, etc.' It contrasted the 'high level of accuracy, the rigour of calculations in school' with the situation in the professional life, in which one had to be able to give a quick approximation, to work fast and to produce useful answers in calculations. Again, both teachers (presumably of older pupils) and professionals subscribed to this journal.

Concluding remarks

From the mid-18th century mathematics journals, primarily meant for teachers, but subscribed to by other practitioners as well, were published in the Netherlands. In the 18th century mathematics was both a respectable pastime and a means to improve the situation of those teachers, who were prepared to learn mathematics; learning mathematics was each teacher's individual choice. *Mathematische Liefhebberye* set out to disperse and enhance mathematical knowledge among teachers in the 18th century. It meant to be a support for those inexperienced in mathematics by more knowledgeable colleagues, while also offering interesting mathematics for the experienced readers. From the early years of the 19th century, one consequence of efforts by the government to improve the quality and standing of primary school teachers was the obligation for all teachers to learn at least some mathematics and preferably more. Mathematical knowledge and pedagogical skills formed from 1806 on part of the requirements for all teachers. All journals discussed above had as their aim to further mathematical knowledge and skills among their readers, primarily through encouraging them to solve problems and send new ones, just like was the case with *Mathematische Liefhebberye*. In this way the emergence of an informal learning community was facilitated, with experienced and less experienced teachers. The very diverse and active group of readers with a wide range of mathematical topics of the 18th century made place for a more narrowly defined group of readers (though still with practitioners amongst them) less topics, more specialization, in the first half of the 19th century. A common focus of the whole period discussed is the driving force of mathematics exams. In the 18th century occasionally, for some vacancies and differing very much between towns; in the 19th century compulsory for all primary teachers, probably not that different from region to region, but with increasing demands for higher ranks. All journals provided material which could be used for teaching and catered for those who practised for exams. We conclude that these journals played an important role in the professional development of teachers.

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