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How the structural crisis in the labour market impacts the quality and identity of mathematics teacher students

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This paper analyses the impact of two structural context factors on mathematics teacher students. First, the Netherlands is coping with a massive mathematics teacher shortage. Second, the Dutch knowledge-economy feeds the private tutoring sector. The impact on young teacher-students is tremendous; they start working as a teacher too early. Besides successful studying, broader professionalization and quality of mathematics education are in jeopardy. A quick-fix for mathematics education might do more damage than foreseen.

Keywords: Teacher students, teacher shortage, shadow education, identity, quality of education.

Introduction

This paper contains an overview of the current situation in the Netherlands when it comes to mathematics education and mathematics teacher training. Many teacher training students start working as an unqualified teacher before they finish their teacher training. The shortage of mathematics teachers and private forms of education lure teacher students into the work field earlier than preferred. Research on this situation seems to be primarily focused on pupils and teachers and not on teacher training students.

Quality of mathematics (teacher) education

There is no single definition of quality in higher education. Harvey and Green (1993, as cited in Onderwijsraad, 2015) distinguish five different definitions of quality. One of them is quality as transformation. It stands for a mutual process between provider (teacher training) and participant (teacher student). This process adds value to the participants and empowers the participant to influence their own transformation into a professional. The educational work field can be seen as a connection between teacher student and teacher training through traineeship, in alignment with the intentions of both teacher training and teacher student. All from the perspective of safe and solid development of professional mathematics teachers.

Biesta (2020a) states quality is not the right word to use in relation to teacher training, because who is against quality? Quality stands for measuring and scoring, which fits the tenor of the knowledge economy in which scoring as high as possible is the most important goal. Commissie Beleidsevaluatie Lerarenopleidingen (2013) emphasizes it is crucial to keep a broad perspective on the development of teacher students. Thinking in competences in teacher education may keep the focus on the technical aspects of professionalization and may lead to a 'training' model instead of a broader 'forming' model. Competencies are important, but should be seen in a broader normative professionalism. This 'forming' model and the model of quality of transformation come near to

Biesta's (2020b) vision about education. Education should not be only about knowledge and competencies employed from the perspective of the current social order. The pedagogical mission of education contains socialization; developing identity and subjectification; being invited to be a subject in and with the world, being a 'self', all in interaction with and interruption by 'the other'.

If mathematics education should involve more than a focus on competencies and qualification, it is important to give mathematics teacher students the opportunity to experience mathematics, mathematics education and the role of mathematics (education) in society in as much depth as possible. The Dutch Knowledge Base is used by universities of applied science to guarantee quality in mathematics teacher training and can be found on the website 10voordeleraar.nl. It is composed by mathematics teachers and teacher trainers and describes the minimal knowledge an incipient teacher should have about mathematics. It states that besides mathematical knowledge (being able to do the math), a teacher should develop general mathematical skills. This means for example being able to use ICT, specify how mathematics is used in other school subjects and 'indicate the impact of society on the development of mathematics'. A broader perspective would be the addition 'how can mathematics be used in other subjects and how does or can mathematics have impact on developments in society'.

In 1980s and 1990s a reform of the Dutch secondary mathematics education curriculum was initiated and implemented. The new Realistic Mathematics Education curriculum (RME) had the aim of making mathematics meaningful for everyone, being connected to reality and being relevant to society (Hoogland, 2020). Students should be supported by constructing their own knowledge and developing mathematical insights (Gravemeijer et al., 2016). In the 1980s the market was led by mathematics textbooks inspired by RME. The tendency of teachers and textbooks to think of instruction in terms of individual tasks and their focus on procedures that generate answers quickly are reasons RME-goals weren't reached (Gravemeijer et al., 2016). Besides that, Dutch mathematics teachers have the tendency to depend on their textbooks (Daemen et. al, 2020). A new curriculum for secondary education is in development. It seems mathematics education might be stuck in a focus on qualification for now, despite the original intentions of RME.

Mathematics teacher education

The Amsterdam University of Applied Science (AUAS) houses the bachelor-study for becoming a mathematics teacher for junior secondary school (age 12-16). The teacher student population is diverse. There are students from urban and rural areas, students with a bi-cultural background, students with a refugee-background, first-generation-students and students who enter from a vocational school or enter from another university. If a teacher-student is successful, the student manages to finish within 4 or 5 years. Unfortunately, not all teacher students are successful. To illustrate this: from the 63 teacher students starting in 2018, only 43% passed the first year course after 2 years of studying. Only half of the 30 full-time teacher-students who started in 2015 with the main phase of their study, a 3 year program, graduated 4 years later. Student teachers who take more than 5 years to study are called 'slow students' (langstudeerders).

Different obstacles cause students in general to need more time to finish their study. Elffers a.o. (2018) distinguish formal obstacles and informal obstacles. A formal obstacle could be not passing exams and informal obstacles are for example being a first generation student or studying with a disability. Student-engagement and thorough guidance of students are important factors for study-success, especially in the first year of studying (Diepen & Elffers, 2019). Although improvement is always possible, pre-teacher-education at AUAS is investing in student engagement. The question arises if there might be other reasons why a substantial number of students are dealing with a substantial study delay. At this point it is time to include factors relating to shortage in the teacher labor market and private tutoring.

Teacher shortage: unqualified teachers, freelancers and growing inequality

The Netherlands has a shortage of qualified mathematics-teachers. A quick search at 'www.meesterbaan.nl', a national vacancy-website for education, shows 85 vacancies for mathematics teachers for secondary education (learners age 12-18) at the beginning of the school year 2021/2022. Assuming these are vacancies at different secondary schools this means 4,7% of all secondary schools in the Netherlands are searching for a mathematics-teacher. Schools are allowed by government to hire unqualified teachers, like guest teachers, teacher students or teachers in another subject to fill the gaps. It is one of the reasons why it is hard to define the exact shortage of qualified teachers (Adriaens et al., 2017). Still the education inspectorate states that in 2016 mathematics was the school subject with the highest number of unqualified teachers, namely 7,4%.

The question of supply and demand on the teacher labour market causes a growing number of teachers to start freelancing for financial reasons and to avoid workload. The Chamber of Commerce claims that the number of freelance teachers in general almost tripled in the past seven years. Freelance teachers are more expensive for schools to hire and freelancers have the opportunity to make demands. For example one can come to an agreement not to attend meetings or seminars at school, do surveillances during examinations or start extra educational projects. This undermines schools being a community or a system in which teachers are caring for the development of their students and each other not only during class, but also outside classrooms. Or put another way, it will reduce schools to institutions for qualification, with less opportunities for socialisation and subjectification.

The number of vacancies is concentrated in the western part of the Netherland. This is the densely populated area of the Netherlands and has more urban regions. Figure 1 shows the expected teacher-shortage in the Netherlands in 2025 compared to 2019. Mathematics (wiskunde) has by far the worst prognoses. De western areas (NH and ZH) will have a shortage of respectively 57 and 73 FTEs. A tight teacher labour market increases turnover in highly urban areas and schools with disadvantaged children. In urban areas there are less young teachers, which could indicate it is difficult to find replacements for leaving teachers (Dijkslag, 2019). When it comes to shortages in urban areas: teaching in a superdiverse context requires extra skills. Teaching in general has the characteristic of being a lonely job and requires full responsibility from day one (Snoek, 2016). The

complexity of teaching in a superdiverse environment causes starting teachers to choose ‘less complicated’ schools (Dijkslag, 2019; Gaikhorst et al., 2019).

The shortage of qualified teachers in these areas has a negative effect on equality of opportunities for students (Elffers, 2019a). The education inspectorate states on their website that students in areas coping with a shortage of teachers receive their lessons more often from non-graduated teachers. Besides that, they have more teachers in one school year than schools in other areas. A teacher shortage enhances inequality of opportunity, stimulates a group of teachers to start freelancing and the number of vacancies for mathematics teachers rises.

	GR	FR	DR	OV	FL	GD	UT	NH	ZH	ZL	NB	LB
Nederlands	2	2	1	2	1	5	4	9	13	1	4	2
Duits	10	7	4	12	6	27	19	37	53	3	21	10
Engels	0	0	0	1	1	2	1	2	3	0	2	1
Frans	6	6	3	10	4	20	14	35	46	3	22	9
Biologie	0	0	0	1	0	1	1	2	2	0	1	1
Informatica	2	2	1	5	2	8	7	20	19	2	11	5
Natuurkunde	6	5	3	8	5	15	11	25	31	3	16	6
Scheikunde	6	4	3	6	4	12	10	23	33	3	12	5
Wiskunde	13	8	5	14	11	27	25	57	73	6	25	11
Aardrijkskunde	0	0	0	1	0	1	1	2	2	0	1	1
Economie	0	0	0	0	1	2	1	1	3	0	1	1
Geschiedenis	0	0	0	0	0	1	1	1	2	0	1	1
Levensbeschouwing	0	0	0	1	0	2	1	1	2	0	1	0
Maatschappijleer	0	0	0	0	0	1	1	1	2	0	1	1
Techniek	0	0	0	0	0	1	0	1	1	0	1	0
CKV, Kunstvakken	0	0	0	1	0	1	1	2	3	0	1	1
Gezondheidszorg en Welzijn	0	0	0	0	0	1	1	1	2	0	1	0
Klassieke Talen	3	1	1	2	2	6	5	13	19	1	8	5
Lichamelijke Opvoeding	0	0	0	0	0	1	1	1	2	0	1	1
Overige Vakken	0	0	0	1	0	2	1	1	2	0	1	1
Praktijkonderwijs	0	0	0	0	0	1	1	1	1	0	0	0
Totaal	51	38	22	66	40	136	107	238	314	26	133	61

Figure 1: Extra vacancies teacher per subject and province in 2025 vs. 2019 (Adriaens et al., 2017)

Shadow education: inequality of opportunity

The Netherlands has a knowledge economy, which brings focus on qualification. Parents put their effort into ensuring their children are as highly educated as possible. This has contributed to the rise of shadow education in the Netherlands. The term shadow education stands for privately funded extra educational activities for learners after school with the intention to improve performance at school (Elffers & Jansen, 2019). Examples are homework guidance, extra private lessons in school subjects, training for exams and summer schools. Mathematics, being an obliged subject in most routes in Dutch secondary schools preparing for university and university of applied science, has been doubtless a profitable school-subject for shadow-education in the Netherlands. Figure 2 shows the spending on shadow education increased eightfold in almost two decades (Elffers, 2019a). Shadow education can cause inequality of opportunity. Not all parents are financially able to pay for private education after school. Teachers might spend less time to give extra guidance to their students and refer to extra lessons (Elffers & Jansen, 2019).

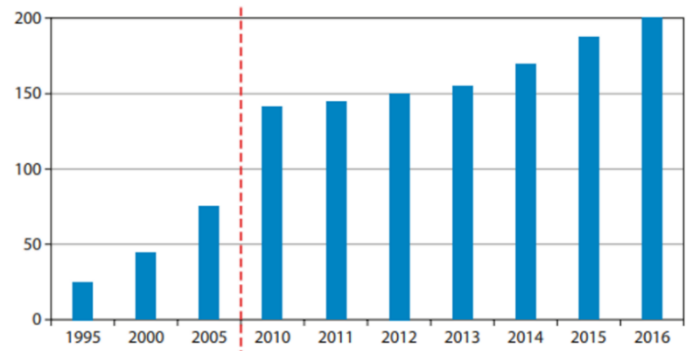


Figure 2: Spending on shadow education in the Netherlands (Elffers, 2019a)

After corona: public and private forms of education can start dating again

Because of the corona-pandemic and its negative influence on education, the Dutch government released 8 billion euros to support national education. This ‘Nationaal Programma Onderwijs’ gives secondary schools two years of funding to help learners get rid of disadvantages due to the corona-crisis. Money can be spent on interventions that are proven to be effective. This can be for example: extra lessons, extra teachers, teacher support, summer programs and weekend schooling. This support plan is the government’s open invitation for public and private forms of education to start to cooperate even more. Shadow education entering public schools is not a totally new phenomenon (Bisschop & de Geus, 2017). The market for shadow-education has been growing due to the Dutch knowledge-economy. (Elffers, 2019a). It seems, when it comes to private education in public schools, in most cases even before the corona pandemic, schools bore the costs or parents were asked for compensation. (De Geus, W. & Bisschop, P. 2017) Both Elffers (2019) and De Geus and Bisschop (2017) conclude more research has to be done on the effects of shadow education on teachers and pupils. An important group of participants is missing in this conclusion, because who are filling the gaps?

Mathematics teachers education students fill the gaps

Since government allows non-qualified teachers to teach at schools in combination with the current teacher shortage, teacher training is coping with schools offering teacher students a job or asking them to do extra educational activities, even before they have finished their teacher-training. This phenomenon is called green picking (groenpluk) (Diepen & Reumerman, 2018).

The AOb, a Dutch teachers union, conducted research with 606 teachers younger than 35 years old by bureau Investico with the topic ‘starting teachers’. The article indicates that almost 60% of the respondents had a job as a teacher before graduation.

Reasons for students to accept a teaching job include: financial incentives, being ‘honored’ and having a ‘good connection with the school’. Not all schools provide proper guidance for starting teachers. About 30 % of the teachers quit after 5 years, because of workload and burn-outs. (Pol & Tunali, 2021).

A short inventory by the author about shadow education and green picking among 24 teacher-students in their first year of study (2020-2021) is shown in Table 1. 12 out of 24 students state they have been active in some form of shadow education. 20 students have been active in some form of private education, which could be, for example, helping a neighbor’s pupil for a fee.

Table 1: Results inventory on activities in education by first year students

Question	Number of students	Percentage
Have you been working as a mathematics teacher besides your traineeship?	7	29 %
Have you been offered a job as a mathematics teacher?	6	25%

Did you receive more tasks besides your internship?	6	25%
Did you give exam training through a tutoring company?	8	33%

So while public education and private forms of education compete and cooperate for employees in the teacher labor market, mathematics teacher education students are filling gaps and put effort in to getting students to access the highest levels in the knowledge economy.

Possible consequences

More research on this topic needs to be done, but still possible consequences can be mentioned. Of course a positive effect might be that teacher education students gain more experience and have context to connect information and activities from their teacher training with their daily practice. However, the way in which the Dutch mathematics curriculum for secondary education has been handled over the past 30 years does not show an inspiring example for a rich mathematics education. Early adoption by the educational field and early development of identity as a mathematics teacher might make it more difficult to stay open to other ideas and concepts. Because teacher students are busy working they will have less time to be creative and innovative and they will have little time to reflect on their experiences being a teacher. The importance of reflection and personal professional development might shift to the background, already being ‘on board’. Even more, hiring teacher students as an unqualified teacher might make them think they are ready to be a teacher. Like a student stated in van Diepen en Reumerman’s research (2018, pp. 19): *‘Thirty hours a week for four years: what is that about? My trainee school says I can be a teacher by the end of this year.’* Just like their employer they will be focused on fast qualification. This might endorse the mindset of ‘finally finishing the training’ instead of the concept of a lifelong personal and professional development. A generation of teachers may stay underdeveloped while being absorbed by the field.

Conclusion: narrow teacher training, narrow mathematics education

Mathematics teacher shortage and shadow education impact the broader development and professionalization of mathematics teacher students. It doesn’t matter if students are ‘slow’ or ‘fast’. Either way they might have the tendency to be focused on their own quick qualification. Meanwhile, they already serve the knowledge economy without room for creative input or any healthy criticism. Since the professional development of teacher students seems to narrow because of this structural crisis on the mathematics teacher labor market, mathematics education itself will stay narrow. This is an alarming situation. Mathematics teachers should not be able to just ‘indicate the impact of society on the development of mathematics’. In current times mathematics education should take part in addressing challenges like climate change, data-abuse or inequality of opportunity and contribute actively to personification and subjectification, a quick-fix for mathematics education is creating the opposite.

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