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The true purpose of mathematics education: A provocation

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ABSTRACT: This paper features an anecdotic narration in which a fictive narrator, addressing the author of this paper, explains the functional role of mathematics education in the maintenance of the bureaucratic society. Drawing from critical philosophy and critical mathematics education, it is argued that the objective of mathematics education as realised in schools is to teach students to understand, accept, follow or at least ignore pre-defined rules as they are required for the bureaucratic administration of modern society. The theory of the narrator is underpinned with explanations that students offered in an interview study conducted by the author. Rather than supporting his alternative theory on a strict methodical basis, the narrator illustrates its explanatory strength in its confrontation with the experiences of students. The 'provocation' does not only lie with the narrator's theory about the nature of mathematics education but with the fact that reality, as it is presented by the students, fits in all too well with the narrator's explanations.

Keywords: Sociology of mathematics education, critical mathematics education, aims of mathematics education, calculation, student narratives.

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Prelude

Well, David, what can we trust in? What can we trust in, once the indisputable holiness of the king has been sacrificed by the *dēmos*, when the order of our gods is being questioned on the *agorá*, when our merchants bring the beliefs of others from over the seas? Who will now give us the hold to see and walk the path that leads us in safety?

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›It is the torment of the philosopher to be confused this way, and there is no other origin of philosophy.‹ — When Heinrich reads Plato, this is what Socrates says to Theaetetus. Here we see where the Athenian quest for knowledge, Socrates's relentless search for the good, the good teacher, the good statesman, the good soldier, originated. It was a quest to overcome the confusion caused by the development of Ancient Greece and to find something new to provide a stable world view. Philosophy was born to answer the question what we can trust in.[1]

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›Fear not, for there is an existence which is not affected by fate and death.‹ — As Heinrich's formula points out, this is the promise which the invention of truth by Parmenides provides us with: ›For it is unborn, also indestructible, whole, unique, motionless‹; ›it is not allowed to become or vanish.‹[2]

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What is Parmenides' demand to believe in an ever-reliable entity but the introduction of an empty signifier which materialises our desire for stability? And what is his demand but one of the first disciplinary techniques? Find yourself a way to believe in truth, or, Parmenides tells us, you will end up as the ›double-headed: For helplessness leads their wandering sense in their breast; and they drift, deaf equally and blind, lost in confused wonder, a bunch unable to decide, considering being and not being as the same and again as not the same.‹[3]

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So, David, let's not be double-headed! Let's not think in terms of becoming and vanishing. Where does this lead us? Something can only *be* if something else *is not*. Contradiction is born alongside the urge to avoid it. Either or, true or false, Black or White, man or woman: we order our world along such contradictions.

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The ontological question to which deduction gives an answer is: How are all these states of *being*, how are all our little truths related to that ›unique‹ idea of truth? Anaximander's proposition that truths are interconnected by being grounded on other truths from which they can be derived by deduction, connects them just perfectly to that super-truth from which, eventually, all can be deduced. Just as the gods bequeathed their traits to their offspring, the polygon bequeaths its properties to the triangle, the natural number to the prime number, the continuous function to the differentiable function.[4]

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Which is the discipline that is free enough from any realistic interpretation so that it can think of concepts totally stable in meaning and fulfilling of our demands for the identification of true and false, for the exclusion of contradictions and undecidedness, and for the organisation of statements in deductive relationships? Is not the strictness of mathematics, which shows in its imperative to define every concept and to prove every statement, the most extreme of all thinkable attempts to withhold the possibility of contradiction and undecidedness and to establish an indisputable and always-reliable truth?[5]

Social order and education

Hahaha, I laugh my ass off when I hear people say that learning maths was important for life. Maths isn't, but what it does with us is. Yet of course, this belief itself is part of the game.

~

Just look at the different stories about the nature of mathematics education that you tell yourselves in research! Do they allow describing what really happens in the mathematics classroom? No? Well then, let me tell you the true purpose of mathematics education! Only promise not you judge me too hastily, and you will see the integrity of my explanation.[6]

~

David, you will want to audiotape me instead of taking these shattered notes. — Why, of course you will want to write down what I have to say. Never again will I be that honest!

~

Let's get the morals straight! Without social order there would be anarchy, and along with it misery, starvation, violence, disease and much more. So, social order is necessary. Pre-historic regimes and the despotic regimes of modernity, which see the pre-historic god-kings reincarnate, secured order by the threat of physical violence, securing control through the permanent threat against the bodies of you and your beloved. But who wants to be governed through violence today? Western society cultivated a less violent form of governance.

~

Aristotle was clear in saying that logic was the tool of the *dēmos* for governing society on the *agorá*. Now that everybody wants to be part of the *dēmos* and the whole country is the *agorá*, how can we establish social order without the permanent threat of violence? Foucault saw it through. We need discourses which people submit to willingly and which have the potential to reach social decisions. And which discourse would be more persuasive than the one whose objects never change, whose truths are always reliable and which allows for no contradiction or undecidedness?[7]

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What are our everyday decisions — epic and broad, or casual and hardly notable? The modern man is a bureaucrat. With bureaucrat I do not only mean those who sit in an office but, in Weber's sense, everybody who developed a certain state of mind, who follows a specific pattern of behaviour. To some extent, we all are involved in reducing the chaos of human concerns to cases, thereby acknowledging selected and pre-fixed extracts of the situations while ignoring others, and retaining the truth of a case along pre-defined rules against its vividness in its individual net of becoming and vanishing.[8]

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Of course, mathematics can play an essential role in such processes, as research on organised calculation shows. But the connection between mathematics and bureaucracy lies on a deeper level of mutual integration. One the one hand, what is mathematisation but the reduction of a chaotic situation to the stability of a mathematical case? What is the solution of the mathematical problem but the bureaucratic, rule-bound dealing with that case? On the other hand, what is bureaucracy but the realisation of the mathematical logic in the spheres of human affairs? To process a case alongside rules which are made to avoid all contradiction and undecidedness is to create in the form of truth the necessity of an otherwise disputable decision on the basis of pure deduction.[9]

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Some people might consider the ignorance of the uniqueness of each situation as a loss of the specific. But this ignorance is, to borrow an Orwellian formula, strength. As Fischer points out: ›Reduction constitutes the usefulness of mathematics. One would not need the abstraction if one could consider everything. Oblivion is necessary, especially when it comes to decisions. He who considers everything never finishes and therefore cannot decide.‹ Beware of the double-headed![10]

~

When it comes to education, what kind of person needs to be produced to keep this social order intact? She has to be able and willing to perceive the world in pre-defined cases and to reach decisions by following pre-defined rules. In the Parmenidian tradition, this administration is ›motionless, it is not allowed to become or vanish‹, it is, to quote Weber, ›dehumanised‹: The ideal bureaucrat acts ›without hate and passion, hence without love and enthusiasm, under the pressure of plain notions of duty, in ignorance of the reputation of the person‹. The ideal bureaucrat is a computer.[11]

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As Horkheimer and Adorno observe, this peace has its price: ›Not only is domination paid for with the estrangement of human beings from the dominated objects, but the relationships of human beings, including the relationship of individuals to themselves, have themselves been bewitched by the objectification of mind. Individuals shrink to the nodal points of conventional reactions and the modes of operation objectively expected of them.‹[12]

Why mathematics education?

Why learn mathematics? — Because you need all these concepts and procedures to solve your problems in later life? Stop kidding! — Because school prepares you for the few you will need? Too ineffective! — Because you learn to think logically? There is no proof and no indication of that. — Because you learn to solve problems in general? No proof either. Why on earth?

~

Let's assume an affirmative answer to Skovsmose's questions: ›Could it be that 'normal' students in fact learn 'something', although not strictly speaking mathematics, and that this 'something' serves an important social function? If we look back again at the 10,000 commandments,‹ directed at the student over years of her life in the form of mathematical problems to solve, ›what do they look like? They might have some similarities with those routine tasks, which are found everywhere in production and administration. An accountant has to do sums day after day. A laboratory assistant has to do a series of routine tasks in a careful way. Things have to be handled carefully and correctly in a pre-described way. Could it be that the school mathematics tradition is a well-functioning preparation for a majority of students who come to serve in such job-functions?‹[13]

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Is it by pure chance that the introduction of mathematics as a compulsory discipline in school in the so-called Western countries of the early 20th century coincides with the proliferation of white-collar work in eventually all spheres of society?

~

Please, let go of your fantasy! For the rest of our conversation admit that mathematics education is not for learning mathematics, but that learning mathematics is but a means to a different end! Over days, weeks, months and years it gives you the opportunity to create yourself as the logico-bureaucratic subject, and it gives us the opportunity to judge your ability and willingness to be this subject.

~

You know, it is funny that you allowed me to have a glance on what your interviewed German ninth graders said about their relation to mathematics. Unlike you, I was not at all surprised by the fact that none of your 23 students reported that they experience your miraculous inquiry-based learning. Have the teacher explain the stuff, then practice it — this is the way it ought to be, as you will come to understand. Just allow me to use your students' narratives in order to show you that my narration is not utopian but has its place in the experiences of those who live in the mathematics classroom![14]

Being the bureaucratic subject

›Well, the biggest difference is that in football you move and in maths you only sit.‹ — Daniel reminds us of bodily experiences that are so basic that they are often forgotten when we talk about mathematics education. The nurse, the timber worker, the football player move; but the office clerk, the telephonist, the researcher and to a large extend even the policeman and the teacher, virtually all who contribute to the administration of our society, have to sit. So let us see if you can be a sitter![15]

~

›Too much writing. Yes, there is too much written on the blackboard. I have the opinion that it could be done shorter.‹ — Yes it could, dear Franziska, but then we would never know how long you can endure writing. And in your future job as a bureaucrat, you will sit and write. — I just hope that the mathematics classroom will eventually undergo the modernisation that the office has gone through years ago: The bureaucrat of today does not write on paper but type on the keyboard and click on the mouse. And so will the learner of mathematics.

~

›You have to be willing to learn and when applying it you have to stay concentrated.‹ — We should not underestimate Rebecca’s thought. Concentration needs to be kept at a high level which might become increasingly difficult during a long day in school or in the office, especially if you have to solve the same problems following the same rules over and over again. So Daniel reports: ›The calculations are also quite long every time, and most of us don’t feel like it anymore.‹

~

Boredom is one of the most central experiences of the mathematics classroom: You yearn for something else and the world beyond the classroom is full of enticement. The same goes for the bureaucrat: You will not enjoy handling the seventeenth case of the day, nor writing another report. Nevertheless, you have to follow the prescribed rules delicately, and therefore you will need to ›stay concentrated‹. You have to bring yourself forth as a subject that finds calculating, as Emma puts it, ›endurable‹.[16]

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The question not only is whether you are *able* to endure this abstract rule-following, but whether you are *willing* to. And there are good reasons why you would not be willing.

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›In maths there is only right or wrong. In German you can always write something and something correct results from it, but not so in maths. So you do not have this variety and there is only black and white. There is simply no in-between, nothing you can talk your way out with.‹ — The logical order is merciless. Its dehumanised mechanics expects everybody to obtain the same result; this is the imperative of the law of identity. A wrong turn here or there and you produce the wrong number, hold the wrong statement true, reach the wrong decision. But what is Ute’s ›in-between‹?

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›In maths there are simply tasks that you have to calculate, and there is nothing personal in it.‹ — As for Wiebke, the possibility to act out one's individuality is largely limited in the mathematics classroom. If self-actualization indeed is, as Maslow concludes, the highest form of human needs, then this limitation cannot but result in unwillingness. Or, to let Helena and Vanessa speak: ›Many students like to talk and to say their opinion, but you don't need that in maths.‹ — ›I like to draw and find it good to be creative and to express myself. In maths there are all the formulas and you are somewhat constrained. That's not my thing.‹[17]

Becoming the bureaucratic subject

Come on, everybody join the maths run! No, we won't stop for you, not even slow down. So don't fall behind, don't lose us out of sight, or you shall be lost! And if somebody leaves a light for you to follow, you'll have to run, run as fast as you can, with nothing around you but the hope to close up!

~

Asked whether she thinks that mathematics classes teach anything else than pure calculation techniques, Julia replies: ›You learn to learn.‹ — And is it a coincidence that *mathēmatikḗ tékhnē*, the Greek expression from which the word mathematics originated, literally means ›the art of learning‹?

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Why is mathematics so difficult to learn? Bianca argues: ›Actually it doesn't have that much to do with maths but rather with the character of the people, because if you're really endeavoured to learn something new you usually can understand it rather quickly, but if you think »Okay, the teacher had his chance and messed it up, so I seal myself off completely«, that does not get you anywhere.‹

~

Why is mathematics so difficult to learn? ›Maybe because the head is being burdened too much, more than in other subjects like geography. There, it is only memorising most of the time.‹ — But what is it that burdens Quinn's head? Is it not true to say that learning mathematics requires a way of reasoning, be it logical, bureaucratic or something else, which is not commonly used in everyday thinking? Is it not true that instead of merely accumulating and reproducing knowledge you have to become someone else, or, to speak in Foucauldian terms, you have to develop a new conduct of the self, a different subjectivity?

~

›Well, I do not want to count myself among those who have understood, because usually this is not the case. This is also a bit up to me, as personally I have some difficulties to generally pay attention in class, especially so in maths, because I often don't understand and also, I don't find it that interesting.‹ — Yes, Helena, the question of concentration is haunting us. And yet, is the ability to concentrate not necessary if you are being explained new definitions of cases and new rules for reaching decisions? Complicated as these might be, they have to be learnt and applied accurately, requiring a focussed mind.

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Where else than in mathematics would we find procedures so abstracted from our reality that we can fully concentrate on following the pre-defined rules, where else could we so easily forget the specificity of reality, where else could we so easily conduct ourselves in a ›dehumanised‹ manner?

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›Well, if you ask for the first time, she explains it to the whole class. But if somebody still hasn't understood and asks again, she does become a little irritated and so. Then she is always stressed out and explains no more. And then, of course, some people still haven't understood.‹ — Good teacher. The mathaton doesn't stop, doesn't even slow down. In office, you will have to understand instructions quickly, and it is utterly ineffective to have people sitting there who regularly require special attention. So, you learn quickly or you're out. That's why Helena's teacher is a good teacher: She teaches her students that the occasions for explanation are limited and that they have to understand quickly. Ute has successfully adjusted: ›Now, in maths, I always listen, because I know that otherwise I won't stand a chance. If you miss class only once, then actually you can forget it completely, then you never need to come back.‹

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Teacher explanations just like any instructions are necessarily incomplete and ambiguous. You would prefer learners who know what you mean, who have the right feeling to add what you don't say, to choose from an array of possible understandings the appropriate one. This ability, of course, depends on the familiarity with the kind of thinking that is cultivated here. To a large extent, it depends on the knowledge we already have in the area, be it mathematics or administration: solutions to exemplary problems, specific procedures, experiences of how to formulate problems and establish cases, eventually everything that provides points of reference for our understanding. However, shifting from elementary mathematics to the contents of middle school, these points of reference are less frequently found in out-of-school experience and more frequently constituted by knowledge from previous teaching. Here it is where you do not only have to combine all your knowledge, but where gaps in knowledge become disastrous if you are unable to fill them yourself. Or, to let Helena explain: ›It is more complicated and more formulas and, yes, you somehow have to know and combine everything at once. And that is difficult of course, especially when you have gaps, just like I unfortunately have.‹

~

As Rebecca reminds us, the understanding of new concepts and procedures is also aided by a more general knowledge of the universal order of thought: ›Some people simply don't understand. They cannot see and grasp connections, so they cannot connect it logically‹. — Whatever that logic that might be, logic in the strict sense of creating and upholding the always identical, of avoiding contradictions and undecidedness, of justifying statements through deduction, or the logic of bureaucratic administration with its reduction of situations to cases, its handling of cases along pre-defined rules and its exclusion of all individual commiseration, it is following a code of speech and thought which does not derive from shared experiences but builds on hegemonic, dehumanised rules. And isn't it Bernstein's heritage to have shown the unequal access to such universalised principles of the organisation of thought?[18]

Why to become the bureaucratic subject

Why does it work? Why should anyone be glad to become the bureaucratic subject?

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Certainly, to our all benefit, there are students who do like to calculate and to simply follow rules. How is that possible, you may want to ask, if humans are striving for self-actualization which the bureaucratic machine denies them? Maslow considers self-actualization the highest need, pursued only if a variety of other needs are satisfied, including the needs for security, morality, belonging, achievement and respect of others. What if following rules and finding the correct results are the easiest or even the only visible way of feeling immune against decay, of knowing what is right, of belonging somewhere, of proving competent or of experiencing appreciation?

~

Horkheimer and Adorno compiled a history of great thinkers who *enjoyed* to subject themselves to a deity they themselves created, to the manifestation of the promise that there is an existence beyond the fallibility and evanescence of humankind, an existence that therefore is unhuman and has to materialise itself in the very same way for every observer. This worship is shared by the Parmenidean search for truth, by the Socratic quest for the good, by the Aristotelean logic as well as by Bacon's modern empiricism, by the Cartesian *ratio*, by Leibniz' *characteristica universalis*, and, of course, by the bureaucratic and mathematical methods in general.[19]

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We should not underestimate the comfort of competence! The body caged in the classroom, the mind may still exclude itself from or immerse itself into the mathematical discourse. And if it does immerse itself and achieves success, what a bliss not only to gain access to a timeless truth, but to have yourself attested more competent than others, with the prospect of reproducing this superiority over years to come! Laura: ›Maths is fun for me because one is very glad if one calculates the formula and it's right. You get a sheet and you have the opportunity to calculate something. I believe for some students maths is kind of a race, they want to win it. When you sit here in class, everybody calculates and when you got it, of course you are glad.‹

~

The mindless but rule-bound operation with symbols may produce an enjoyment of its own kind in form of an experience which psychology calls ›flow‹. For Rebecca, ›maths is for relaxing, like headphones-on or dancing.‹[20]

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›I feel good when I explained something to somebody and he has understood.‹ — Rebecca's experience points to an even deeper experience: Instead of only mastering the exclusive techniques of mathematics and allying with the eternal and ever-present, you have the power to grant others that mastery and alliance.

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On the other side, as Laura adds, the threat of failure is always present as a motivational force in the mathematics classroom: ›It is stupid if you can't do maths, if you don't master it. It is simply embarrassing.‹

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›Whether you are building a playing ground outside or somehow planting a flowerbed or generally do anything, you always have to somehow think mathematically in order to somehow get things done how they are planned.‹ — David, you have already discussed the ideology of the relevance which not only Wiebke here, but nearly all of your students assign to mathematics, how this is one-sidedly directed at learning, at learning a set of specific mathematical techniques, especially techniques of elementary mathematics, and how students fail to connect this discourse with their experiences in the mathematics classroom. Why then does this discourse, which Dowling rightfully describes as myths of mathematics education, unfold such a dominance in our perception?[21]

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›You simply can't be bothered with it, because with some exercises you think that you won't ever need that again. Because none of us wants to study something with maths later. And that's why it sometimes appears so senseless, and you do not understand why you should do that now.‹ Emma's point appears to contradict Wiebke's, but in your interviews you can see that most students hold both positions. Why do they uphold this paradox discourse? Well, these students ignore the utopian character of the discourse around the relevance of mathematics in a Lacanian ›as if‹ behaviour: Although students know that the mathematics they learn is useless, they choose to participate in the discourse which attributes practical relevance to mathematics education, thus allowing them to enjoy learning mathematics as a meaningful activity.[22]

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The lack of explanation of the relevance of mathematics is a condition of the possibility of mathematics education. As proclaiming that mathematics education prepares and selects you to uphold the dehumanised, routinized administration of our society is considered politically incorrect in light of the liberal call for an emancipative education, cultivating a pseudo-discourse, which at the end of the day reveals mathematics education as a senseless activity, is the best you can do. For the senselessness of learning mathematics reflects the absence of meaning in any link of the bureaucratic chain; sense is subsumed under the mechanics of the dehumanised machine. Only in open confrontation with this senselessness the student can develop the ability and willingness to perform the bureaucratic act.

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Eventually, some students such as Venessa are even grateful, for mathematics education makes them obtain a valuable qualification that they would not pursue voluntarily. Asked if she would put maths in her self-made timetable, she explains: ›Probably so, because you simply need it for later life. I believe I wouldn't do maths on my own accord and this is how I would force myself to do it.‹

The productivity of failure

Now I talked a lot about those who become subjects to mathematical and bureaucratic thinking. What about those who don't? Obviously, they pose a threat. In their inability or unwillingness to follow mathematical procedures and bureaucratic regulation, they might eventually attack our social order as conceptually over-simplified in its opposition of right and wrong, hypocritical in its claim for objectivity and justness, inhumane for its abetters and ignorant of individual uniqueness. In lack of a just alternative for the organisation of society they threaten us with chaos, they are the ›double-headed‹ who are ›lost in confused wonder‹ and ›unable to decide‹ that Parmenides warns us about. Luckily, mathematics education has approved mechanisms to deal with this menace.

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Just imagine the psychology of the repeated experience of not understanding in a situation which you cannot avoid, which you are bound to by law! — ›You can also despair when you are sitting there all the time, never finding the solution.‹ — Laura's despair might eventually erupt to more intense feelings towards the learning of mathematics as in the case of Anna: ›Sometimes I'm sad because I again didn't understand. And I'm also somewhat afraid that the others will laugh at me because it was easy for them. That the others think that you're stupid. One girl even cried.‹

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›Well, a result of this could be that later they can't be bothered with maths at all, because they connect it with something negative.‹ — Simon hits the point. Despair and anxiety are part of the productivity of failure. In the form of the Foucauldian internalisation of forms of conduct, learning to despair when facing mathematics motivates an attitude of avoidance or anxiety towards mathematics, eventually leading to a mentality that dares not question the dehumanised processing of human affairs. Skovsmose understood: ›A large group of students might be left, and they will have learned a substantial lesson: that mathematics is not for them. To silence a group of people in this way might also serve a socio-political and economic function.‹[23]

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Laura explains how her classmates learned to perceive mathematics as something unpleasant: ›I believe they think that they do not understand it. Maths gives you that, this feeling that maybe you did not immediately understand. Many of them then leave the classroom thinking: »Wow, what did I actually understand? Nothing!« Then, when you are left with this and when you take an exam and get a bad mark and it always goes on like that, I believe then you stop enjoying maths.‹

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In the mathematical world where the quality of every statement can be reduced to right and wrong, and that necessarily without any disagreement between different observers, success and failure are most easy to determine, mathematics is used, as Socrates had described long ago, as an indicator of intellectual ability. The inability to obtain the right result in any procedure comes to represent a general flaw of the subject's thinking, its disconnectedness from truth. This is the way in which Anna fears to be labelled as ›stupid‹ or the reason why Ute has learnt to mistrust her intellect: ›What do I lack? Well, logical thinking sometimes. Occasionally I'm actually good in spatial thinking but as soon as it has to do with numbers I lack it.‹

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Social narratives about mathematical ability, be they gendered, ethnical, based on socio-economic background or on whatever else, prove supportive for this technique of self-exclusion. Even though Ute is aware of the flaws of such explanations, she locates her problems in mathematics following such a rationale: ›We are in any case a rather language-oriented family. Actually nobody there was every good at maths. I believe that it's really like that: If, from one moment on, you're always telling yourself or being told that you can't do it anyway, also by teachers and your environment, or when your whole environment is not that engaged, then it's also not too bad if you're not that good yourself, then the expectations are not that high.‹

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The mechanisms that lead those students who are not able or willing to participate in mathematical and bureaucratic thinking to despair are well supported by the disciplinary techniques which teachers use to conduct the classroom. Humiliation as experienced by Anna, although admittedly unpleasant for both the teacher and the student, might be the most effective of these techniques: ›She just calls up somebody. Also those who do not want. Then, when I cannot do it, I do feel exposed in front of the class. Often I learn at home and try to understand, but I don't. Then, she could well help me and not desert me like that.‹

~

Eventually, just like with any normative pair of contrasting concepts as Foucault has shown us, the inability or unwillingness to learn and follow the abstracted procedure of mathematics creates the idea of a lack in mathematical intellect, more generally in logical thought or even in thought in general, in the first place. However, this disability, which manifests itself in bad marks or dropped courses, is a requirement, firstly to encourage students, who do not want to be labelled intellectually disabled, to become the bureaucratic subject, and secondly to publicly justify the exclusion of sceptics from critical positions in society. Here, we also find the second reason for the narrative that mathematics was taught in order to learn elementary mathematical skills which are needed in later life: Following this belief, failure in mathematics proves your intellectual inability and your dependency on experts. The sceptics have learnt to bend down; social order is saved.

Research in mathematics education

Before I come to an end, let me say a few conclusive words about the role that the so-called research in mathematics education plays in this system. You will have to admit that mathematics education first of all is a pedagogic discipline which is well described by Bernfeld: ›The great pedagogues feel for the child: affection, love, pity, hope, disgust, terror. And this, their feeling, their personal reaction to existence, is for them the problem, is for them the pivot of their science, is their instrument of observation. They do not see the child as it is but ultimately only the child and themselves, each in relation to the other. And if they were able to abstract from themselves, they would not be interested in how the child is in itself but only how something else would be formed out of it. The child is the means for a theological, ethical, socio-utopian goal.‹ — Is this mentality not reflected in the quest to educate the logical thinker, mathematical modeller or general problem-solver?[24]

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The all-pervasive rhythm of explanation and exercise, the domination of routinized procedures and the total absence of any experiences of becoming a logical thinker, mathematical modeller or problem-solver in your students' narratives show the failure of the pedagogical endeavour. Whence this schism between the dream of the theorist and classroom practice? Lundin already gave the answer: This quest for reform is but a camouflage which legitimises mathematics education as the emancipative institution it is supposedly able to become, and through its ignorance of the socio-political mechanics of the classroom it secures its ever-present bureaucratic nature without having to formulate it as the anti-liberal project which it is.[25]

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The ignorance towards the social function of mathematics education, that is the preparation of a bureaucratic workforce and the legitimisation of the bureaucratic government of society, is its condition of possibility. It is not only manifest in the ideological camouflage of educational goals and the role of research which legitimise mathematics education in the first place, but operates through every student. The student, who has to be ignorant of what is to be learned in order not to protest against it, cannot explain failure. Why does Helena fail? ›Because I have difficulties to understand it. Why? Um, actually I don't know exactly. It doesn't seem to suit me well. Well, I really don't know.‹

~

›I already got better marks in maths, because he really waits and doesn't continue until everybody has understood. And that's really good for the whole class.‹ — For the support of your idealistic ideology of the purpose of mathematics education, it is only too good that there are always some teachers who reignite our hope for a better education. Gina's teacher, possibly a real master of his art, and his class might enjoy this style of teaching, and for many of you researchers he might be the shining proof that change for the better is indeed possible. But at the end of the day, neither do we need everybody to become a bureaucratic thinker, nor will waiting-for-everybody annul the fact that some students are more fit and eager to think bureaucratically than others.

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Eventually, there are also students who support your idealistic ideology of the purpose of mathematics education: ›I would really like to not only have one way which is always written in the book (how you get there, so to say), the way we always extrapolate ourselves through logical contemplation. Only that perhaps you have a second way, because, as the saying goes, there are several roads leading to Rome. And that you really let the students contemplate on how you get there, really this logical contemplation. It is really important, in many subjects and also generally.‹ — Oh Bianca, what shall we do with that creative mastery of yours? Luckily, our society also needs those who define the limits of the cases and the rules for their handling which others face as pre-defined; luckily, we also need the rule-makers. Just like protagonist Bernard in Huxley's *Brave New World*, she who understands the mechanics which rule society all too well, cannot follow them anymore and craves for alternatives, is rewarded with being exiled to an island which is crowded by like-minded who rule the world. Only that Bianca's island is situated right in our midst.

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Thank you for your attention! Haha, what an intimate presentation! Sorry, I have to get going now. — Yes, I'm really serious. Just think about it!

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1 The quotation is a translation of Socrates's statement ›Μάλα γὰρ φιλοσόφου τοῦτο τὸ πάθος, τὸ θαυμάζειν· οὐ γὰρ ἄλλη ἀρχὴ φιλοσοφίας ἢ αὕτη‹ from Plato *Theaetetus* 155d. Unlike common English translators such as Jowett (Plato, 1892) and Fowler (Plato, 1921) who translate *páthos* as feeling and *thaumázein* as wonder, Heinrich (1981/1987), whose translation is followed here, allows for a deeper interpretation by sticking closer to the original text and translating *páthos* as torment (*Leiden*) and *thaumázein* as confusion. The interpretation of the origins of Greek philosophy is presented in Vernant (1962/1982).

2 The first quotation is a translation of a fictional proclamation which Heinrich (1981/1987), a German philosopher who discussed the origins of philosophy and logic on the basis of Marxism and Freudian psychoanalysis, presents to escalate his psychosocial interpretation of the introduction of the concept of truth to philosophy by the pre-Socratic scholar Parmenides. The second and third quotations are translations of the description of truth in Parmenides (2009, pp. 19, 21).

3 The quotation is a translation of a description in Parmenides (2009, p. 17). Disciplinary techniques, in the sense of Foucault (1975/1979), are techniques for the conduct of the self

whose development is motivated by external demands, eventually leading to an internalisation of these originally external demands. Here, the threat to be expelled as a ›double-headed‹ motivates readers to subject to logical thinking.

[4] The narrator refers to Anaximander (2007) who introduced the concept of cause to philosophy and presented the oldest recorded cosmology that does not refer to gods. The spiritual interpretation of Anaximander's work builds on Heinrich (1981/1987).

[5] Kollosche (2013; 2014) provides a sociological interpretation of the development of logic in Ancient Greece under consideration of mathematics education.

[6] Different narratives about social functions of mathematics education are discussed in Kollosche (2016).

[7] The narrator first refers to Aristotle's *Prior analytics* (1989, 52b–53a), then to Foucault's (1975/1979) concept of disciplinary techniques.

[8] The narrator refers to Weber (1972) who, in the first years of sociology, provided a profound description of the social and mental mechanisms of bureaucracy.

[9] Research in organized calculation is a young field of study established in Germany by Vollmer (2004) and analysing the use of mathematics in decision-making processes in big institutions. The connections between bureaucracy and calculation are discussed by Kollosche (2014; 2015).

[10] The narrator is first referring to the formula ›ignorance is strength‹ from Orwell's novel *Nineteen eighty-four* (1949) and then citing the Austrian mathematics educator Fischer (2006, p. 42).

[11] The last two quotations are the narrator's translation of Weber (1972, p. 129)

[12] Citation from the *Dialectic of Enlightenment* (Horkheimer and Adorno, 1944/2002, p. 21).

[13] The narrator is citing from Skovsmose (2005, pp. 11–12).

[14] The narrator refers to data that was collected in an interview study with 23 students from the area in and around Berlin, Germany. The students attended the eighth, ninth or tenth grade and different school tracks. They came from different schools and were randomly chosen to participate in a voluntary semi-structured interview about their general relationship to mathematics, including questions such as ›What is your favourite subject and what do you like about it? How does it differ from maths?‹ and ›Are there situations in mathematics where you feel particularly good or bad?‹ The interviews were transscribed and the narrator had access to them.

[15] Citations which are accompanied by first names refer to specific interviewees. All names have been changed preserving gender. The citations have been translated into English and sometimes parts of the statements have been omitted or linguistically smoothened without rendering their meaning.

[16] The experience of mathematics as boring is a phenomenon that has been repeatedly reported by students in empirical studies from different Western countries (Kislenko, Grevholm, and Lepik, 2007; Lange, 2009; Kollosche, 2017).

[17] The narrator is referring to the hierarchy of human needs as presented by the US-American psychologist Maslow (1943).

[18] The narrator is referring to Bernstein's (1965/1971) work on elaborated versus restricted codes of communication.

[19] The narrator is referring to Horkheimer and Adorno's *Dialectic of Enlightenment* (1944/2002).

[20] The mental state of flow was first described by Csíkszentmihályi (1975).

[21] The narrator is referring to one of my other publications (Kollosche, in press).

[22] As Žižek (1994) explains, the psychoanalyst Lacan showed that people can *act* 'as if' an illusion was real although they already *know* that it is not.

[23] Skovsmose (2005, p. 12) is cited here.

[24] The narrator is citing a translated passage of Siegfried Bernfeld's (1925/1979) psychoanalytical analysis of pedagogy (pp. 36–37).

[25] The narrator is referring to the work of Lundin (2012).

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