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Beyond Postmodernity in Mathematics Education?

Ole Skovsmose¹

Abstract: A radical form of postmodernity is presented with reference to Nietzsche's ideas with respect to truth, knowledge, sciences, progress, democracy, and ethical values in general. Thereafter is presented Foucault's archaeology of knowledge. This brings us forward to the notion of *genealogy*, which is a defining idea for the postmodern conception of critique. However, it is emphasised that a critique can address the *generativity* of mathematical rationality by considering mathematics-based fabrications. Finally, *imagination* is presented as yet another feature of a critical enterprise. It is illustrated how such a three dimensional critical enterprise is relevant for both mathematics and mathematics education. In this way the paper suggests moving beyond the postmodern outlook.

Key-words: critique, genealogy, generativity, fabrication, imagination, postmodernity, mathematics, mathematics education.

Whilst postmodernity has brought new profoundness to critical activities, it has also formed some limitations. I find it important to address both aspects and in that way try to move beyond postmodernity. I am going to discuss this possible move with reference to mathematics and mathematics education.

The label postmodernity has been used widely with reference to new trends in architecture, art, and literature which break with modernist principles; it has been used with reference to new conditions for knowledge production; and it has been used in social theorising to refer to new social and cultural phenomena. I am going to use postmodernity as a reference to a critique of Modernity, and I will concentrate on philosophical aspects of this critique.

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Modernity itself can be associated with some general conceptions of science: that natural sciences will be able to reveal the secrets of nature, and that science in general can be both objective and neutral. An integral feature of Modernity is the recognition of the importance of science, knowledge and education, and the whole Enlightenment project makes integral these aspects of the modern outlook. Furthermore, Modernity can be associated with the emergence of ideas about democracy, freedom, and equality. Clusters of such different ideas are brought together by the notion of progress: self-improvement is a human possibility.²

Taking a closer look at the modern period we find that very different socio-political phenomena developed together with the scientific discoveries, the formulation for democratic ideals, and the preoccupations about enlightenment and progress. Colonialism and exploitation took many forms, racism as well. During Modernity one finds laborious attempts at providing a scientific underpinning of racist classifications of human beings as being more or less developed. Similar classifications were applied to languages: some were identified as being more developed and complex than others. Such ethnic and linguistic classifications were weaved together with notions of progress and development and theorised into grand discourses that could legitimate colonialism and suppression.³ Zigmunt Bauman made a gloomy addition to such observations by emphasising that even the holocaust can be seen as being made possible through discourses established within modernity.⁴ With such observations we have entered a fierce critique of Modernity, and this is what postmodernity is about.

Let me try to summarise how we are going to proceed. I will present the most radical form of postmodernity by outlining some of Nietzsche's ideas about truth, knowledge, science, progress, democracy, and ethical values in general. Then I will present an example of the archaeology of knowledge by referring to studies by Foucault. This brings us forward to the notion of *genealogy*, which is defining for the postmodern conception of critique. I will discuss genealogy with respect to mathematics education and emphasise the extreme importance of this line of critique. However, I will then emphasise that a critique addressing *fabrications* that can be related to mathematical rationality is crucial as well. Finally, I want to add *imagination* as crucial for a critical activity. By bringing

² For a discussion of the notion of progress see Bury (1955), and Nisbet (1980).

³ See, for instance, Said's study of orientalism (1979).

⁴ See Bauman (1989).

together genealogy, fabrication and imagination I try to broaden and deepen critical enterprises, and in this way to move beyond postmodernity.

1. Nietzsche's radical postmodernity

Friedrich Nietzsche confronted the official grand narratives of Modernity.⁵ He found that Modernity – although it had taken steps away from orthodox Christianity –was still lingering in a religious world-view. Nietzsche acknowledged that since Descartes all philosophers had tried “to assassinate the old concept of the soul”, and in this way philosophers have attempted to “assassinate the basic assumption of Christian doctrine.” However, Nietzsche's point is that “overtly or covertly modern philosophy is anti-Christian, although it is by no means anti-religious” (*Beyond Good and Evil*, §54). And this is the problem.

Maybe modern philosophy has assassinated the soul and other religious notions, but it maintains a religious outlook by installing new idols. The modern idols have the form of philosophical ideas through which reality becomes judged. Nietzsche's postmodernity hammers into pieces any such idols. Let us look at them one by one.

The idea of truth. According to Nietzsche there is no truth to be found anywhere.⁶ We talk, and not least through Modern philosophy, as if we are able to discover truths. The distinction between appearance and reality plays a fundamental role in the modern world view, as presented by Descartes, Galilei, Locke and many others; it was crucial as well for the formulation of Platonism which Nietzsche is also attacking. The distinction points out that behind appearance there is reality, and the claim is that true knowledge concerns this reality. But, according to Nietzsche, there is no reality behind appearance: “The ‘apparent’ world is the only one: the ‘real’ world has only been *lyingly added...*” (*Twilight of the Idols*, Reason in Philosophy, §2).⁷ The reality behind appearance

⁵ In *Ecce Homo* Nietzsche makes comments on his previous publications and about *Beyond Good and Evil* he states that it is in essence a critique of modernity (*Ecce Homo*, *Beyond Good and Evil*, §2). It could naturally be added that Nietzsche confronted much more than the Modern outlook: Christianity in general and the whole philosophical tradition since Plato.

⁶ See also Clark (1990).

⁷ In this and all other citations the italics is made by Nietzsche in the original.

is a myth. There is no reality which truth is about. Nietzsche asks: “What, then, is truth?” And he answers: “A mobile army of metaphors, metonyms, and anthropomorphism – in short, a sum of human relations which have been enhanced, transposed, and embellished poetically and rhetorically, and which after long use seem firm, canonical, and obligatory to a people: truths are illusions about which one has forgotten that this is what they are; metaphors which are worn out and without sensuous power; coins which have lost their pictures and now matter only as metal, no longer as coins.” (“On Truth and Lie in an Extra-Moral Sense”) Truth has no permanence; it is an illusion. Truth is not about anything; it is a way of talking; it is a mobile army of metaphors. Truth is just a modern idol that has substituted ideas about the existence of paradise and of an eternal life after death.

The idea of knowledge. Nietzsche introduces a radical perspectivism.⁸ There are no points outside the stream of life from where one can look at things, judge things, and formulate true statements. One is instead submerged into this stream. Nietzsche’s perspectivism destroys any hope of establishing knowledge, according to any Modern aspirations. What is called knowledge does not represent any “insight” about certain states of affairs. As a consequence, Nietzsche reaches an epistemic Darwinism: “It is improbable that our ‘knowledge’ should extend further than the strictly necessary for the preservation of life. Morphology shows us how the senses and the nerves, as well as the brain, develop in proportion to the difficulties in finding nourishment.” (1968: 272, §494) Formulated differently, one can see the brain as an organ among other organs. It is an organ necessary for our survival. The secretions produced by the brain are no more unique than the secretions produced by any other of our organs. Sweat is necessary for our survival, and so is knowledge. That we happen to call the output from the brain “knowledge” does not make it any different than any other forms of biological extracts.⁹ The problem, however, is that the notion of knowledge, through immense philosophical misinterpretation, has become reified as an idol.

The idea of science. If knowledge is not about anything, and certainly not about truth, what then to think of science, the celebrated institution of Modernity? Just a different idol. Science cannot represent any search for truth as there is no such thing to search for. What then to think of the phenomenon that is in fact

⁸ See also Hales and Welshon (2000).

⁹ Nietzsche states that the “sense for truth” will have to legitimise itself as a “means for the preservation for man, as *will to power*” (*The Will to Power*, §495). The sense for truths is useful like any other senses. It helps to ensure our survival.

referred to as science? Nietzsche simply states: “A ‘scientific’ interpretation of the world, as you understand it, might therefore be the most stupid of all possible interpretations of the world, meaning that it would be one of the poorest in meaning.” (*The Gay Science*, §373)

The idea of progress. It has been claimed that progress is a defining element in Modernity. In the essay “A Discourse on Inequality” from 1755, Rousseau emphasises that, contrary to animals, human beings have a “faculty of self-improvement”.¹⁰ This idea is axiomatic for the whole Enlightenment, which claims that knowledge and education are crucial for the common welfare and for progress in general. The *Encyclopaedia*, to which Rousseau also contributed, is an expression of the idea that knowledge should be collected and divulged broadly.¹¹ Nietzsche just shrugs his shoulders: “The last thing I promise is to improve humanity.” (*Ecce Homo*, Prologue §2, my translation) And even more explicit: “ ‘Progress’ is merely a modern idea, that is to say a false idea.” (*The Anti-Christ*, §4)

The idea of democracy. As progress is an illusion, one should not expect Nietzsche to think any better of democracy, which has been celebrated as part of modern progress. Nietzsche has not anything positive to say about the French Revolution, and in general he finds nothing worthwhile captured by notions like liberty, equality and fraternity. Instead Nietzsche sees democracy as a miserable expression of a herd moral: “Indeed, with the help of a religion that played along with and flattered the most sublime desires of the herd animal, we have reached the point of finding an ever more visible expression of this morality even in the political and social structures: the *democratic* movement is Christianity’s heir.” (*Beyond Good and Evil*, §202)¹² Furthermore he characterises “modern democracy ... as the decaying form of the state” (*Twilight of Idols*, §39). Nietzsche is certainly not to be found in any democratic camp.

Ethical values. According to Nietzsche, the slave morality put values upside down by celebrating the poor, powerless, suffering, deprived, sick, ugly, etc., and by nominating the noble, powerful, and beautiful as evil, cruel, lustful

¹⁰ See Rousseau (1984: 88).

¹¹ It should be noted that Rousseau not only presented the notion of self-improvement; he also developed a counter story to the general celebration of progress by commemorating the natural state of affairs.

¹² Nietzsche also observes: “The *overall degeneration of man*, right down to what social fools and flatheads call their ‘man of the future’ (their ideal!); this degeneration and diminution of man into a perfect herd animal; this bestialization of man into a dwarf animal with equal rights and claim is possible, no doubt about that!” (*Beyond Good and Evil*, §203)

insatiable, and godless (*Genealogy of Morality*, First treatise, §7). This slave morality is, according to Nietzsche, contrary to life as “life itself *in its essence* means appropriating, injuring, overpowering those who are foreign and weaker; oppression, harshness, forcing one’s own form on others, incorporation, and at the very least, at the very mildest, exploration” (*Beyond Good and Evil*, §259). Thus Nietzsche emphasises that “ ‘exploitation’ is not part of the decadent and imperfect, primitive society: it is part of the *fundamental nature* of living things, as its fundamental organic function; it is a consequence of the true will to power, which is simply a will to life” (*Beyond Good and Evil*, §259). After such claims it is not surprising that Nietzsche sees democracy as an idol; just a modernised version of slave morality.

It would be a risky business to try to assume the whole Nietzsche package including all its pre-modern post-modernity. And this is not what has been done, but Nietzsche’s radical post-modernity has inspired many.¹³ His radicalism invites for a *deconstruction* of celebrated ideals. The notion of deconstruction was formulated by Jacques Derrida in *On Grammatology* first published in 1967, and I find that this notion describes precisely what Nietzsche is suggesting as well as what many postmodern investigations are completing.¹⁴ I will use it as a general characteristic of postmodern critical endeavours, naturally acknowledging that Nietzsche talked about genealogy when identifying ideas as idols. The general claim is that behind apparently decent scientific standards, aspirations about progress, ethical values etc, one will find much less noble forces acting out. The aim of a genealogy (a deconstruction) is to reveal this reality – so different from any idealist reality that has just been “lyingly added”.

2. Foucault’s archaeology of knowledge

According to modern standards, science should not be subjective, but objective; it should not include special priorities or particular perspectives, but distance itself

¹³ See Deleuze (1986) for a careful interpretation of Nietzsche’s ideas in general and in particular between the Apollonian and Dionysian ways of life.

¹⁴ Derrida is inspired by Heidegger who uses the notion *Abbau*, for deconstruction ideas. This German word resonates with *Aufbau*, which means construction. Thus *Aufbau* and *Abbau* can be seen as an inverse processes. *Abbau* can be read as destruction, but it is better understood as an unmaking, thus Derrida emphasises: “The movements of a deconstruction do not destroy structures from the outside” (Derrida, 1974: 24)

from any interests. Furthermore it was assumed that science, due to its own intrinsic dynamic, does in fact acknowledge such demands. So, if one just lets science develop according to its intrinsic standards it will reach objectivity and neutrality. Thus science is an expression of solid epistemic standards.

Inspired by Nietzsche, one should consider the trust in science as being a variation of a religious trust, just worshipping different idols – as false as any other idols. In “Truth and Juridical Forms”, Michel Foucault refers several times to Nietzsche as an important source of inspiration. Foucault does not address natural science, but concentrates on psychology, psychiatry and related discourses. He pursues the idea that the polished surface of sciences covers a muddled situation. He presents his archaeology of knowledge in terms of a genealogy. Through detailed historical studies he demonstrates how any claim about objectivity and neutrality evaporates. What constitutes facts at a particular historical moment becomes questioned in the next moment. Facts appear time-dependent as do truth and scientific categories.¹⁵ It appears that science is developing, not in any continuous process of accumulation, but sometimes in surprising and apparently irregular ways. In the interview “Truth and Power” Foucault refers to a particular observation that illustrates his point: “In a science like medicine, for instance, up to the end of the eighteenth century one has a certain type of discourse whose gradual transformation, within a period of twenty-five or thirty years, broke not only with the ‘true’ propositions it had hitherto been possible to formulate but also, more profoundly, with the ways of speaking and seeing, the whole ensemble of practices, which served the purpose of medical knowledge.” (Foucault, 2000: 114)

One has to do with some overall and radical changes of a scientific outlook. In some places Foucault talks about an episteme as comprising a broad set of ideas, assumptions, conception, priorities that function as a scientific world view for a particular science at a particular moment. Foucault also uses the notion of discourse for such a world view. So what Foucault is referring to above is a change of a medical discourse taking place within a relatively short period. This change included changes of what were considered true propositions, and as emphasised by Foucault this change included not only a change in ways of talking; it also included changes of medical practices. As sciences become constituted through discourses, and discourses are condensing complexities of ideas, priorities, interests, etc., sciences becomes deprived of all idealised

¹⁵ It is interesting to compare this observation with Grabiner (1986), who asks if mathematical truths are time-dependent.

standards. Discourses are expression of powers, and as a consequence knowledge and power becomes intimately connected. Thus through his genealogy, Foucault deconstructed any idealised conception of science. In fact we have got close to Nietzsche's perspectivism including the observation that behind any idealised surface there exists a chaos of powers.

This dynamics becomes condensed by Foucault through the notion of "regime of truth". In the interview "Truth and Power" Foucault states: "Each society has its regime of truth, its 'general politics' of truth – that is, the types of discourse it accepts and makes function as true; the mechanisms and instances that enable one to distinguish true and false statements; the means by which each is sanctioned; the techniques and procedures accorded value in the acquisition of truth: that status of those who are charged with saying what counts as true." (Foucault, 2000: 131) So what Foucault observed with respect to medicine was a change of a regime of truths. And, as pointed out, it is possible to observe such changes with respect to many different scientific discourses. Through the notion of "regime of truths" Foucault draws directly on Nietzsche's characteristic of truth as "mobile army of metaphors, metonyms, and anthropomorphism".

Through his investigations of discourses Foucault made an important contribution to critical enterprises. He showed that what is assumed to be stable is far from being so. Truth is time-dependent; it is context-dependent; it is power-dependent; it is dependent on whatever. The notion of fact has simply become dissolved through Foucault's acid deconstruction.

3. Genealogy

Foucault's studies of genealogy have inspired many critical investigations of education and of mathematics education. Let me, however, concentrate on the later.¹⁶

Many general formulations that accompany mathematics education are in need of being deconstructed. Thus in official documents one can read, most often in a highly elaborated vocabulary, that the aim of mathematics education is to provide mathematical knowledge that can be of general interest for society and of personal relevance for the students. Such formulations assume that knowledge and

¹⁶ For Foucault-inspired discussions of education see, for instance, Popkewitz and Brennan (Eds.) (1998).

education provide an important source of welfare, both for the society and for the individual. With reference to educational practice and acknowledging the formulated aims, one finds many suggestions for improving classroom practice. This reflects another of the grand ideas of Modernity, namely that improvements and progress always have to be worked for.

Genealogies have pulled aside such decorative formulations, and there is much inspiration to be found in Foucault's work for doing so. In *Discipline and Punish*, Foucault talks about discipline, disciplinary society, and disciplinary institutions, and among them the school. With reference to the military Foucault states that "discipline increases the skill of each individual, coordinates these skills, accelerates movements, increases fire power", etc. (Foucault, 1991: 210). Discipline is a defining element in military efficiency. Similar observations, however, apply equally as well to workplaces, hospitals, prisons, and schools: "The disciplines functions increasingly as techniques for making useful individual" (Foucault, 1991: 211). Usefulness can be applied to any category of people and to any institutions in society. However, at the same time "usefulness" is defined with reference to a specific social order. Thus Foucault emphasises that the "growth of a capitalist economy gave rise to the specific modality of disciplinary power" (Foucault, 1991: 221). This power imposes a "political anatomy" in all kinds of institutions, also in schools.

To this observation one just need to add that mathematics as a school discipline also functions as a discipline in Foucault's interpretation of the word. With reference to Foucault, one could claim that mathematics education is observing the political anatomy necessary for establishing usefulness. This observation implies that the formulated aims and good intentions that accompany mathematics education are only serving a decorative purpose. They are lyingly added. Our society is organised according to the demands of the free market, and the educational institutions are docilely responding to the definition of "usefulness" as exercised by this market; mathematics education as well. Such observations bring Thomas Popkewitz to summarise and deconstruct the Modern self-understanding in the following way: "Mathematics is one of the high priests of modernity. Mathematics education carries a salvation narrative of progress into the upbringing practices of schooling. The mathematics of the school is told as a story of progress about the cultured, modern individual whose reason is bounded by the rules and standards of science and mathematics. The narrative is of the enlightened citizen who contributes to the global knowledge society" (Popkewitz, 2004: 251-252). This is a self-understanding that covers the disciplinary reality of mathematics education.

Let me try to summarise some of the very many observations addressing mathematics education as a disciplinary institution. One characterising feature of mathematics education is the many exercises that – lesson after lesson after lesson – are presented to the students. Considering general formulations about, say, leaning mathematics and creativity, the regime of exercises seems paradoxical. However, this regime can be interpreted as preparing for what I have called a prescription readiness.¹⁷ This readiness refers to a capacity of completing small tasks that are defined from outside, that should not be questioned, and that should be completed promptly and with accuracy. Such a prescription readiness makes part of the political anatomy, which defines what is useful and what is not. It can be identified as one of disciplinary features of mathematics education.

Mathematics education makes part of an extended system of tests, examinations, and labellings, which can be considered crucial for establishing the anatomy of the coming labour force. This force needs to be useful; however, there are very many forms for usefulness. For the functioning of the whole capitalist machinery of production, administration, surveillance, transport, economic transactions, etc. one needs a differentiated labour force with very different qualifications. Thus the capitalist machinery operates with a matrix of different forms of usefulness, and this makes a meticulous labelling of individuals crucial. The educational system is taking care of this. As a consequence, students leaving the education system can be located in the proper cell in this matrix of usefulness. A careful labelling of products put out at the market makes things easier for the consumers. This also applies to the labour market of the capitalist society. Among the different school disciplines, mathematics appears eager to provide labels.

Mathematics education makes part a network of power relations. Thus to understand what is taking place in the mathematical classroom cannot simply be studied this classroom. One needs to consider the whole context of schooling. On several occasions, Paola Valero has presented a diagram with a teacher-student-mathematics triangle in its centre, representing the activities in the mathematics classroom. However, she emphasises that this triangle only represents a small part of a grander network, including: youth culture, labour market, family, community, teacher education, staff, school leadership, mathematics education research, international comparisons, policy-making, academic mathematics, technological and scientific development, etc.¹⁸ All such factors, and in particular the power

¹⁷ See Skovsmose (2008)

¹⁸ See Paola Valero's figure as shown in Menghini, et al. (Eds.), (2008: 286).

relations between them, are relevant for interpreting the actual disciplinary functions of mathematics education.

Many postmodern analyses have tended to stop at this point. This would in fact be in accordance with Foucault's approach. A genealogy reveals the powers that operate behind the educational scenery. Naturally we could ask: And what then? Considering the result of the deconstruction, how to improve the educational reality? By formulating such questions we might be sliding away from a postmodern approach. Thus we have to remind ourselves of Nietzsche's remark: "The last thing I promise is to improve humanity." And this formulation can easily be translated into: The last thing a deconstruction could promise is to improve mathematics education. In fact a proper deconstruction – not assuming any of the modern ideals (or idols) including a notion like progress – must leave things as deconstructed.

Many postmodern approaches have assumed this position. I acknowledge that any form of genealogy in terms of a deconstruction is important. However, I do not want to assume that a genealogy represent the whole range of critical approaches. I want to address two more elements by addressing fabrication and imagination. This way I want to bring critical enterprises beyond a post-modern outlook.

4. Fabrication

As the notion indicates, a genealogy is working its way back in time. Through his archaeology, Foucault presented a history of "the given"; he demonstrated how a scientific discourse, a particular regime of truth, become established as a conglomerate of preconceptions. Such critical investigations are powerful, I fully acknowledge this. I want, however, to point out that there are other forms of critical investigations also relevant for mathematics education. Let me illustrate what I have in mind by referring to mathematics. An archaeology with respect to mathematical ideas will dig into their historical origin and try to reveal how knowledge-power dialectics makes part of their genealogy.

One can, however, also address the rationality of mathematics by investigating what can be accomplished through this rationality. What does it mean to bring this rationality into operation? What can be generated through this rationality? What possibilities can be established? What dangers and risks can be established as well? This brings us to consider what can be *fabricated* by means of

mathematics, and in what follows this notion has to be interpreted in a general philosophical way as referring to *homo faber*. I see questions about fabrications as being different from those addressed by a genealogy. While a genealogy concerns the past, fabrications concern the future. Thus fabrications are addressed through studies of *generativity*, which refers to what can be generated or fabricated through mathematical rationality.¹⁹ Such fabrications can have many forms, and I just provide a brief summary:²⁰

Fabricating possibilities. Mathematics makes part of a range of design processes within any technological domain, and here I use technology as referring not only to technological artefacts, like bridges, airplanes, computers, etc., but also to less tangible constructions like schemes for production, health programmes, techniques for surveillance, economic strategies, management principles, etc. In all such areas mathematics provides powerful means for identifying new possibilities. Furthermore, no natural-language formulation of possibilities operates in an equivalent way. For fabricating new possibilities within our already highly mathematised environment, mathematics is unique.

Fabricating facts. It is common knowledge that mathematics makes it possible to describe facts. To claim that mathematics fabricates facts might sound strange, but let us consider an information system through which knowledge and information becomes processed. This system is operating in terms of a computer language including several layers of formal languages. It can be considered a conglomerate of mathematical algorithms. Such a system can, for instance, configure a tax system. This system not only describes taxes; it also prescribes taxes. It condenses decisions about what people have to pay in tax. And there are information systems not only prescribing taxes, but also medications, treatments, loan conditions, working standards, etc. And also such prescriptions become life conditions to a range of people. They turn into facts.

Fabricating risks. Development of technology depends on simulations. This applies to the construction of cars, airplanes, transport systems, houses, shopping centres, robots for production, tax systems, etc. Blue-prints for such constructions have the form of mathematical models. One could assume that a mathematical

¹⁹ For a discussion of the notion of generativity, see Skovsmose (2011b).

²⁰ The following summary follows Skovsmose (2009). Mathematics-based fabrications have also been addressed in terms of mathematics in action. See, for instance, Christensen and Skovsmose (2007); Christensen, Skovsmose and Yasukawa (2009); Skovsmose (2009, 2010a, 2010b, 2010c, 2011); Skovsmose and Ravn, O. (2011); Skovsmose and Yasukawa (2009); Skovsmose, Yasukawa and Ravn (draft); Yasukawa, Skovsmose and Ravn (draft).

simulation model provides a description of the construction when completed. This is, however, only partly true. The completed construction contains a range of properties which are not anticipated by the simulation model. Many of the risks we are now facing – for instance with respect to atomic energy, economy, transport, health care – are connected to not anticipated implications of implemented technologies. And a mathematical model only anticipated things within a particular range of algorithmic rationality.

Fabricating objectivity. Turning an entity into an object of study means that we strip it for a range of properties. This process is supported by mathematics, which highlights precisely the mechanical elements of what we are studying: being a new architecture, a medical treatments, a new configuration of a production line, new security matters, etc. Mathematics helps to fabricate what becomes addressed as an object. In many cases this “objectification” makes one assume that we are addressing things in an “objective” way; but objectivity can be seen as a mathematics-based fabrication.

Fabricating life worlds. Our life-worlds are submerged in mathematics-based fabrications.²¹ If necessary our body becomes treated according to medical standards about blood pressure, cholesterol, glucose, etc. They are all calculated standards, with reference to which diagnoses are formulated, medical treatments are prescribed, and health is monitored. Standards for food quality are calculated as well: What should be considered acceptable levels of pollution is determined through statistical investigations, cost-benefit analyses, market interests, modellings of consumers’ behaviour, all condensed into well-defined numbers nominating what to call non-problematic. Very many work processes take place in highly elaborated technological environments, where automatic processes and human activities are combined into an efficient production system. The market, including the labour market, is structured according to a huge set of mathematically formulated laws and principles. Our transport systems and our means of communication are all expressions of mathematics-based fabrications. In this sense our life-worlds are fabricated.

Naturally, one can see some overlapping between a genealogy and studies of generativity, but still these studies are different. Through a genealogy one see what has been incorporated, or *acted-into* a phenomenon, while a study of fabrications addresses what might be *acted-out* from the phenomenon. Both forms of investigation play important roles in critical investigations. We have illustrated

²¹ The notion of life-world is used by Husserl, but I am using the notion rather liberally (see Skovsmose, 2009).

generativity in terms mathematics-based fabrications. This way we have addressed mathematics rationality critically. Naturally, we can also discuss generativity with respect to mathematics education. This is a crucial feature of addressing mathematics education critically. However, we now move on to a third feature of critique.

5. Imagination

Beyond genealogy and generative studies there is one more element that I want to consider part of a critical approach, namely imagination. Critique in terms of imagination has been presented by Wright Mills (1959) in terms of sociological imagination. Through such imagination one can reveal that something being the case could be seen differently. This means that one reveals a fact as being, not a necessity but a contingency. I find that a pedagogical imagination makes part of a critical educational endeavour.

Let us assume that we want to establish democracy in the classroom. We want teacher and students to address each other on equal terms and to interaction becomes dialogical. We imagine that this facilitates new learning processes and ensure an empowerment of the students. They could develop more profound new competences in reading and writing the world, to use some formulations that have been explored by Eric Gutstein (2006). And we could expand further our imagination by exploring not only the notion of democracy but also dialogue, empowerment, and related notions like equality, and social justice.

However, one can see all such ideas as illusory by highlighting constraints that configurate the educational reality. We can remind ourselves of the power-network that any classroom practice makes part of. Imaginations do not make changes possible; instead imagination could be the carrier of illusions. Inspired by Nietzsche one can see pedagogical imagination as worshipping idols. The point of the careful genealogy that has been conducted with respect to mathematics education is precisely to reveal that beneath the decorative discourse of aims and possible improvements one finds a disciplinary regime. Considering the decorative discourse, everything seems possible, while considering the disciplinary regime nothing appears possible. And certainly not to establish any genuine classroom democracy as mathematics education as a discipline is doomed to insert a prescription readiness into the students and to subject them to a meticulous labelling. The deconstruction of the classroom reality brings into the

open a grid of power relations that establishes a range of necessities which turn pedagogical imagination illusory. This is one line of argument that brings imagination in discredit.

There is, however one more line of argument discrediting imagination, drawing directly on Nietzsche's radical postmodernity. What to think of the range of the very concepts that resource imaginations such as: democracy, dialogue, empowerment, equality, social justice, etc.? According to the deconstruction of the educational reality, such notions might bring about illusions about what could be done in the classroom. According to Nietzsche, however, such ideas are themselves idols. Following he presentation in *Twilights of the Idols* they should be addresses by a hammer. Idols need to be destroyed. Thus the idols developed through Modernity represent religious ideas, although in philosophical disguise. And the ideas that resource pedagogical imaginations belong to the same family of idols. By celebrating such idols one falsely condemns reality by providing suggestions for improvements. However, according to Nietzsche, there are no norms and standards that operate from any elevated position, and certainly not from any transcendental position. There are no ideas positioned outside the stream of life. Everything makes part of a chaotic power dynamics. Within a radical postmodern approach to education there is no use of ideas stimulating a pedagogical imagination. They just represent romanticism and naivety. The falsely condemn the educational reality.

But could we get around this sharp corner, and move beyond postmodernity? Foucault (2000: 33) raises the question if one can talk about "powerless truth" and "truthless power". In other words: Could there be any truths that are not aligned with power? Could there be false powers? Or does power simply define truths? I do not clearly see Foucault's response to this question. I want, however, to answer clearly myself: truth can be powerless, and power can be truthless. If we make this assumption, we are moving away form Nietzsche's radical postmodernity. But are we heading straight into romanticism?

We have to be careful. Nietzsche knocked down any ideals as were they idols. He feverishly attacked any form of transcendental idealism. To Nietzsche any ideas are formed within the stream of life. I agree with this. So let us not try to revive any new form of transcendence. But does that put an end to any ethical principles and any conception about democracy, equality, justice? My principal point is that ethical principles and idealised notions need not be revealed or discovered. They can be constructed. *I want to propose a social constructivism with respect to ethics.* I see ethical standards and idealised notions as emerging through laborious social processes. They are human constructions, and as such

they are historical; they are temporary; they can be changed. They represent human visions, expectations, and hopes; and precisely visions, expectations, and hopes make part to the stream of life. For me imaginations cannot be discharged, as done with reference to Nietzsche, through the claim that they assume a transcendental reality. They do not. Imaginations make up part of life. They represent the claim that what is the case, it not *necessarily* the case. They try to reveal facts as contingencies. To me such revelations are important critical activities.

Let us now return to the claim that imaginations are illusions due to the very educational realities. Schools as disciplinary institutions are no simple contingencies. They make part of the whole power-network within which the educational system is caught, like a small insect in a spider's net. This power-network includes so many restrictions that one cannot assume that, say, democratic principles could be established in the classroom. This could be obstructed by the traditions of the classroom, the students' expectations, the demands for test and control, the expectations of parents, the organisations of the textbooks, the general time pressure for the teachers, etc. I agree that all such observations could very well bring us to the conclusion that establishing democracy in a particular classroom is (almost) impossible. Still, and this is my point, imaginations – also imaginations that cannot be implemented – is of critical importance. For me it is an important critical step to explore the scope of contingencies. Any particular social institution is positioned between being a necessity or an open contingency. This also applies to the education. There is no *a priori* analysis that designates every feature of this disciplinary institution as being necessary. It is, like any other institution, criss-crossed by contingencies. Naturally, seeing a difference is very different from making a difference, but this does not make imaginations superfluous. Seeing a difference is an initial critical act; making a difference might be possible.

I have been concerned about some postmodern limitations of critical activities which reduce critique to genealogy. I agree that a genealogy is an extremely important critical device. I also agree that this form of deconstruction has gained tremendous force through postmodern investigations. My position, however, is that critique has more dimensions. Genealogy is important, so are generative investigations, and so is imagination.

6. As conclusion: Beyond postmodernity

Mathematics education has been criticised through genealogical investigations. This way it has been revealed how a disciplining order has become incorporated into this form of education, and how power dynamics are operating in and behind classroom practices. However, there is no need to stop the critical investigations by such deconstructions. We can address the generativity of mathematics education in different contexts and with respect to different groups of students. What possibilities could be constructed for them? This question could be addressed not only with reference to further disciplinary initiatives, but also in terms of students' perspectives and with reference to their life-worlds. It is important that any educational practice should become recognised as a contested practice, and this brings us directly to the notion of pedagogical imagination.

I suggest that a critique of a phenomenon, referring to mathematics or to mathematics education, addresses its genealogy, its generativity, and that it becomes contrasted with imaginations. The postmodern form of critique focussed on genealogy. That gave an impressive depth to many critical studies, but it also inserted limitations. My point is to broaden the critical activities I suggest that it is possible to move beyond some limitations postmodernity has put on critical enterprises.

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