CRITIQUE, GENERATIVITY AND IMAGINATION

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One of the grand narratives of Modernity tells us about the objectivity and neutrality of science; in particular it celebrates natural science as demonstrating the ideal scientific format. During Modernity mathematics developed a special status; it was considered a sublime, if not a divine, rationality. Another grand narrative, liberalism, conveys the general celebration of liberty, equality and fraternity; and it cultivates ideas about social justice. Liberalism has, however, also turned into a general celebration of the powers of the market, claiming that they need to be set free in order to secure the general welfare of society. Simultaneously, Marxism tells us about the increasing exploitation of workers and points out political actions necessary to change society. Furthermore, there are grand narratives related to colonialism and to racism, narrating, even with enthusiasm, about the "white man's burden"

The notion of *critique* has grown up and multiplied along with such grand narratives It has become an integral part of some, while simultaneously, challenging others. Whatever it has done, critique is not independent of such narratives. The grand narratives of Modernity have been challenged and this means that the concept of critique must also be challenged. Critique needs critique.

In this article, I want to point out that some important changes in the conception of critique are taking place. These changes also apply to the notion of critique used in critical education, as well as in critical mathematics education. [1] Thus, I will address conceptual issues that I find are crucial for the further development of critical mathematics education. Let me also emphasise that I consider critical mathematics education and mathematics education for social justice as being, in practice, synonymous, although there are differences in the conceptual histories of critique and of social justice. [2] In the following, however, I concentrate on "critique".

The emergence of modern conceptions of critique

Modernity represented a step away from dogmatism. By dogmatism I refer to the claim that some authoritative texts contain truths about certain issues. The Bible may serve as an example, but many texts other than the Bible have been read in a dogmatic way In general, dogmatism assumes that some truths have been encoded in certain texts, and that a proper interpretation of these texts will bring their truths to light

The emergence of what can be referred to as modern conceptions of critique can be related to the principle of universal doubt, as proposed by René Descartes: if it is possible to doubt a statement, one cannot consider it certain and therefore it cannot count as knowledge. This doubt confronted any form of dogmatism, since dogmas can be doubted As a consequence, any dogmatic assertion had to be removed from the assumed stock of knowledge. The principle of universal doubt caused an epistemic tsunami so forceful that, according to Descartes, nothing was left except a single stony statement: *cogito, ergo sum*. This statement represented the solid ground upon which knowledge could be built

Once this ground had been identified, the construction of the whole edifice of knowledge could begin As an instantiation of knowledge, the *cogito, ergo sum* demonstrated, according to Descartes, the criteria for knowledge: only a statement as evident as *cogito, ergo sum* could be counted as knowledge. In other words, the justification of knowledge had taken a radical anti-dogmatic format: justification came from the perception of certainty. Knowledge should be evident and this evidence was a human experience. No justification of knowledge need be looked for outside of human rationality

What I refer to as modern conceptions of critique can be summarised in the following way: a critique should prepare the ground for obtaining *certainty* and *truth*; it should be an expression of *rationality*; and it should include a search for the proper *foundation* of knowledge. I choose to talk about "modern conceptions of critique" in the plural, as we are dealing with a multitude of critical approaches woven together with different aspects of Modernity To talk about modern conceptions of critique is just a convenient way of emphasising some (sometimes rather feeble) resemblances among a range of language games, including "critique"

Descartes prepared the layout of modern conceptions of critique, although he did not explicitly talk about critique: that was to come. In particular, Immanuel Kant and Karl Marx added two heavy, almost non-overlapping chapters to the grand history of critique. One can consider Kant and Marx to be the critical hardliners of Modernity.

Kant's main idea was that some fundamental notions were not derived from empirical observations, but, instead, preceded such observations. Thus, the notions of space and time were not distilled from experience Instead, they established universal categories for organising experiences And, according to Kant, the principal task for a critique was to identify any such *a priori* categories. Kant turned critique into a principally epistemic project, through which one could identify the universal human conditions for obtaining knowledge.

Inspired by Hegel, who in turn drew heavily on Kant,

Marx took critique to a quite new location. On the one hand, Marx found it important to criticise all established economic theories, as they neglected the principal features of economic reality. The formation of capital, for example, had not been grasped correctly, and Marx pointed out that this formation was a direct result of the exploitation of labour. One goal of Marx's critical enterprise was to reveal the hidden and brutal mechanism of capitalism. On the other hand, Marx wanted to criticise not only economic theories, but also economic reality itself. He wanted to address the very exploration of labour. In this way, critique became not just an epistemic project, but a political one as well.

Different as they are, there are important similarities between the critical approaches of Kant and Marx. They each wanted to provide solid foundations and to establish certainty and truth. Thus Kant wanted to provide a foundation of knowledge in general, while Marx wanted to provide a solid foundation for political activities. To both Kant and Marx, critique was a rational affair. Therefore, I consider Kant and Marx to be two hardliners in the development of modern conceptions of critique.

Such conceptions have proliferated in many ways within education and some trends in critical education have assumed different features of them. Some approaches try to establish critique as a rational affair by showing how arguments and recognised ideological positions can be questioned. Some demonstrate the inspiration of Marxist terminology by assuming that the aims and tasks of critical education can be formulated with direct reference to the class struggle. Other trends in critical education have drawn on Habermas's studies. In *Knowledge and Human Interest,* Habermas (1971) connects the social sciences with an emancipatory interest - for some the defining interest of critical education. Habermas tries to define the true nature of knowledge-constituting interests and to provide the notion of emancipation with genuine clarification. Thus Habermas unites aspirations from both Kant and Marx, and one can consider *Knowledge and Human Interest* to be a closing chapter in the history of modern conceptions of critique.

Challenging modern conceptions of critique

Modern conceptions of critique have been challenged and I want to mention two examples: one provided by Michel Foucault, another by Walter Benjamin. While Foucault challenged critique as a pursuit of truth, certainty and foundations, Benjamin challenged critique as a directly rational affair. These challenges are important for opening up new features of critical approaches in general and to mathematics education in particular.

Foucault (1989, 1994) wanted to dig into the foundations of knowledge, although with important differences compared with Kant or with Habermas. First, Foucault addressed particular instantiations of knowledge. Second, he was excavating foundations, not with any aspiration of revealing their universal nature or to identify proper knowledge-constituting interests, but in order to reveal how fragile and mischievous they were. Through a genealogy, an archaeology of knowledge, Foucault tried to show how the foundation of knowledge was first of all made up of a collection of presumptions. In this way, he demonstrated how foundational assumptions include particular interests of the most dubious kind. Instead of seeing foundations as a noble epistemic ideal, they were revealed as serving particular interests. In this way, a dialectic between knowledge and power was laid bare. Foucault's genealogy represented a new form of critical enterprise.

What was established and maintained as knowledge included a powerful insistence on what to call true. Foucault talked about the "regime of truth", which is a metaphoric expression for knowledge-power dialectics. In the interview "Truth and Power", Foucault states that "[e]ach society has its regime of truth, its 'general politics' of truth - that is, the types of discourse it accepts and makes function as true" (Foucault, 2000, p. 131). In this statement, "society" can refer, for example, to a scientific community, or to a period of time, and, naturally, it can have all its normal meanings. Grand narratives, including the grand narratives of modernity, define regimes of truth.

Regime means domination while truth has been assumed to signify genuine epistemic ideals. Thus, by talking about a regime of truth, Foucault highlights the intimate relationship between knowledge and power. Regimes are powerful; still they are temporary. Regimes try to dominate; they set standards; they make exclusions; they make alliances; they can be overcome anyway. And such observations apply to regimes of truth as well.

Foucault departed from certain instantiations of knowledge: psychology, psychiatry, social sciences, and humanities in general. He revealed how notions related to norms, standards, deviation, madness and sexuality were all integrated into regimes of truth. In this way, he confronted directly any modern celebration of science, including its objectivity and neutrality. However, Foucault did not address the so-called exact sciences and mathematics. As I will discuss in the next section, science and mathematics also represent a massive domain of knowledge-power interactions. Thus there is much more to be expected from an archaeology of knowledge than the excavations of Foucault.

Nevertheless, through his genealogy Foucault made an important addition to the notion of critique. He did not let critique operate in any sanitised *a priori* landscape. Instead, he turned it into a highly contextualised activity. A critique does not provide any genuine foundation for knowledge; it serves instead to show the dubious character of assumed knowledge. To Foucault, a critique is no search for certainty. It is, indeed, almost the contrary: through a critique one may reveal the temporality and doubtfulness of established knowledge and of any truth-claims. In this way, Foucault helped to cut the connections between critique and some of the grand narratives of Modernity.

Benjamin contributed to the Critical Theory movement. But, a closer look at some of his writings suggests that he was far from submitting himself to any recognised analytic pattern. He took, instead, an important step, different from and somehow more radical than Foucault's, beyond modern conceptions of critique. Benjamin was engaged in a radical, even anarchic, transgression of established critical rationalities.

In *The Arcades Project,* Benjamin (1999) developed the idea that the arcades - the glass covered streets constructed in Paris during the 1820s and 1830s where people could walk

from shop to shop without being concerned about weather or transport - displayed much about the society in development. Benjamin saw the arcades as indicative of new features of society. They were an expression of a new luxury in consumption and, to Benjamin, they also provided a window on society. The arcades were the modern bazaars and the forerunners of the shopping centres now spread all over the world.

Benjamin presented his investigations in a surprising format. He did not try to develop a critique of society in any systematic way; there were no theoretical clarifications accompanying his walk through the arcades. His investigations did not result in any coherent text written by himself. Instead he operated with an inventive form of noticing. He made a note of this and a note of that; he copied a piece of this text and a piece of that text. He ended up with a monstrous pile of notes, most of which were quotations. These notes were organised in "convolutes", through which he tried to provide some order to his observations. (Benjamin referred to what must have been huge folders as convolutes, as do the editors of *The Arcades Project*.) In *The Arcades Project*, there are convolutes about: arcades, fashion, boredom, eternal return, iron construction, exhibitions, the collector, dream city, the flâneur, theory of knowledge, prostitution, gambling, mirrors, Marx, *etc*. And in each convolute, Benjamin's own notes became mixed up with all kinds of copied texts. Like a surrealist artist, using bit and pieces from posters, journals and magazines to make a collage, Benjamin tried to organise his pile of notes into a panoramic insight. This collage constitutes *The Arcades Project*.

Through this project, Benjamin opened up a new critical approach. Critique need not be systematic; it need not be placed on any platform. Horkheimer and Adorno had emphasised to Benjamin that a study of Marx was indispensable for understanding the time period Benjamin was addressing. Sure enough, there is a convolute labelled "Marx". However, leafing through this convolute, one does not find anything resembling a systematic reading. Instead, there are here-and-there notes. There is no picture of Marx in total. Instead Marx is torn to pieces, some of which Benjamin found gaudy enough for his collage. His critique takes an anarchistic format, methodologically speaking.

Through *The Arcades Project*, Benjamin takes critique far beyond Kant's transcendental accuracy and Marx's profound systematics. But Benjamin's critique does not take the format of a genealogy, as proposed by Foucault. Benjamin's critical approach opens up a multiplicity of perspectives, associations, connections, trends, possibilities and uncertainties. His critique is not regulated by well-defined procedures. It includes imagination and creative features.

What should we call the outcome of the critical turbulence to which Foucault and Benjamin contributed? Post-modern notions of critique? I prefer, however, not to use the label "post-modern", as it draws on a range of other assumptions which should also be questioned.

Critique and generativity

Let us now consider what might happen to the notion of critique when its modern roots are challenged and we pursue further the ideas proposed by Foucault and Benjamin. To keep this article short, I restrict myself to two issues: in this section, I discuss critique and *generativity*, while in in the next section, I discuss critique and *imagination*. In this way, I will try to articulate some new features of critique. I will also indicate what these ideas could mean for critical mathematics education.

It is a principle idea of critical mathematics education to question any celebration of mathematics. However, for centuries the rationality of mathematics has been celebrated. Thus, during the so-called scientific revolution, mathematics was assumed to provide a genuine insight into nature. This claim took on a profound religious significance. Descartes, Galilei, Newton and their contemporaries were all deeply religious and took God's existence as a given. According to them, nature was created by God and the laws of nature were an expression of his creative power. As these laws had a mathematical form, God must have created nature according to a mathematical blueprint. This idea gave mathematics a sacred significance. Mathematics reflected not only the structure of nature; it also represented the rationality of God. And human beings shared this rationality with God! There were really good reasons for celebrating mathematics. In fact, one can see this celebration as one of the grand narratives of Modernity.

A genealogy may serve as a deconstruction of the authority of mathematics. Let us, however, take a closer look at the following remark made by Foucault: "If, concerning a science like theoretical physics or organic chemistry, one poses the problem of its relations with the political and economic structures of society, isn't one posing an excessive complicated question?" (Foucault, 2000, p. 111). Sure. However, it is important for me to emphasise that the natural sciences, including mathematics, are just at forcefully linked to the political and economic structures of society as any of the sciences addressed by Foucault. Thus with respect to mathematics, the economic requirements are extreme, both in terms of the need for funding, as well as for profitable outputs. Here, the knowledge-power interaction has turned into an extreme. We therefore have to take a step further than Foucault, who did not pay much attention to the so-called exact-sciences in his archaeological studies.

A critique of mathematical rationality can take the form of a genealogy. And it is crucial that mathematical ideas, procedures and perspectives are deconstructed by revealing the socio-economic complexity of their origin. This is, in fact, the basic idea of social constructivism, which interprets the construction of mathematical ideas as a social process (see, for instance, Ernest, 1998). Such a genealogy may reveal powerful regimes of truth operating in the name of mathematics that have not been addressed by Foucault.

However, a critique of mathematics needs to address not only its genealogy but also its *generativity*. While a genealogy looks backwards, a study of generativity looks forwards, addressing questions like: what could be the implications of operating with a mathematical rationality? What are the potentials of this rationality? What could be achieved by mathematics-based action? What could be achieved by whom? What kind on dominance could be exercised through mathematics? What kind of risks accompany mathematics-based actions? *Etc*.

I see a genealogy and a study of generativity as supple-

menting each other. They are important approaches for addressing mathematics critically. Thus, I suggest that Foucault's critical approach be extended in two ways. First, it has to encompass the exact sciences, including mathematics. Second, it has to address not only the genealogy of notions and ideas, but also their generative potentials. These two extensions are important for the further development of critical mathematics education.

The point of investigating *mathematics in action* is precisely to reveal to what extent mathematics-based actions forms our social reality (see, for instance, Christensen, Skovsmose & Yasukawa, 2009; Skovsmose, 2009b, 2010; Skovsmose & Yasukawa, 2009). Mathematics is not pure and detached. Quite the contrary: it comprises huge generative potentials. In any technology, including construction, schemes of production, management, forms of communication, knowledge and information processing, techniques for surveillance and control, economic planning and transaction, risk estimation, *etc.*, we find mathematics in action. And such actions can have all kind of qualities. They can be inventive, brutal, cynical, money saving, risky, *etc.* There are no qualities, good or bad, that, in general, can be attributed to mathematics in action. The qualities of such actions have to be addressed in each particular case.

Mathematics in action is part of the formation of new technologies. This formation depends on mathematical conceptions of possibilities. The explosive development of all forms of communication and surveillance technologies is a principal example of mathematics-based innovation. Through technological innovation, mathematics and power become intimately connected. There are many examples of the use of mathematics-based analysis designed to anticipate the implications of major technological initiatives. Thus, any risk assessment of a proposed new power plan in an area at risk of earthquakes is mathematics-based. By conceptualising what is feasible and what is not and by providing a discourse of justification, mathematics and power are further integrated. Mathematical rationality is often materialised through technology; thus, all forms of automation embody mathematical algorithms and procedures in action. In this way, mathematics becomes part of our reality. Thus mathematics can be seen as the iron constructions of the epoch we are entering. We see arcades not only covering streets and shops, but in vast landscapes of production, consumption, communication, *etc.*

It is important to criticise mathematical rationality whatever form this rationality might take: pure mathematics, applied mathematics, everyday mathematics, any form of ethnomathematics. No form of mathematics in action is immune to critique. Such a broad critique of mathematical generativity is crucial for any further development of critical mathematics education.

Critique and imagination

Mathematics education may serve many different functions, and there may be a huge gap between the explicit, formulated aims of mathematics education and its actual socio-political, economic and cultural roles. According to Louis Althusser's structural Marxism, education is instrumental for the ideological structuring of society. Thus the education system will prepare young people to enter the capitalist order of society, to operate as workers, and to do so in a submissive way. And mathematics education is part of this preparation for obedience. Furthermore, this structuralism claims that the very notion of educational improvement is, at best, meaningless; it is more likely, however, that any educational "improvement" simply facilitates a further submission of educational practices to the capitalist order of things. This observation has strong implications for the understanding of critical education. Critique at any local magnitude does not add up to any proper critique. The capitalist order of society has to be changed in order to make sense of small-scale educational changes. I am, however, not convinced of the irrelevance of small-scale educational changes.

Critical mathematics education can draw on conceptions of critique that are not derived from grand narratives like Marxism. It is important not simply to understand critique as a transparent analytical device or as a pre-guided political activity. A critique need not be regimented by any analytical order. In particular, an important step beyond modern conceptions of critique is taken when critique is related to *imagination*. Critique can mean an exploration of possibilities which need not be related to socio-political changes overall: one can consider possibilities in everyday situations, possibilities in the personal life of students, possibilities in the classroom, *etc.* (see Skovsmose and Penteado, 2011).

For an imaginative exploration of possibilities, one should not expect to draw on any well-defined methodology. Critique can include many creative features, and inspiration can be found in Benjamin's analytical anarchism. Metaphorically speaking, a critique can be composed of many convolutes, including sketchy notes, singular observations, and loose ideas. Thus a critique of educational practices might take the form of an artistic patchwork, to which both students, teachers, and researchers may contribute. Whatever imaginative elements a critique may include, they are important to a critical mathematics education.

I have tried to facilitate the imaginative dimension of critique through a discussion of *landscapes of investigation* (see Skovsmose, 2001, 2011). Such landscapes refer to different teaching-learning milieux. They represent different ways of engaging with mathematics and they provide different framings of teacher-student interactions and interactions among students. The discussion of landscapes of investigation serves the purpose of inspiring pedagogical imagination within a specific context. It might be possible to open a particular exercise for further exploration; to consider how a mathematical theorem can be illustrated through different examples; to explore mathematical strategies for certain games; to explore what exercises might grow out from reading a newspaper; and to explore how project work may address real-life problems. Many teachers and students contribute to a pedagogical imagination by illustrating how classroom practices could be different. I have personally learned much from noticing how teachers and students, in collaboration, explore features of a landscape of investigation.

An *exploration of possibilities* can also be seen as an important feature of critical research. Much research, how-

ever, is merely descriptive, as is much research inspired by Foucault's genealogical approach. Descriptivism in education has been justified by the claim that proper research needs to be grounded in empirical investigation, that identifies, for instance: the atmosphere of the classroom; the students' activities as well as their conceptions of certain mathematical ideas; the teacher's communicative strategies; the evaluation of the students; the economic regulation of schools; the political and ideological domination of schools, *etc*. I agree that it is important to research what is the case, the given, the actual, including all its constraints. However, it is important for critical research to move beyond descriptivism. Thus, it is important to imagine alternatives, which can be specific, general or illusory. Imagination can have many different qualities, but it always confronts the given. [3]

A feature of critical practice and research is to address not only the given situation but imagined situations as well. Furthermore, it is important to consider what could be done differently, acknowledging the constraints that condition the particular teaching-learning processes. Perhaps only some smaller changes are possible, but small does not mean irrelevant. Thus my point is that critical practice and research address tensions between: (1) what is actual; (2) what could be imagined; and (3) what could be tried out.

Explorations of possibilities, both in the classroom and in research, bring critique and imagination together. To be critical means to recognise that what appears as given might be contingent: it could be different. Daily educational practice includes many constrains set by the socio-economic situation. But it also includes contingencies that mean that something could be done differently. However, contingencies are not revealed through strict descriptivism; imagination is necessary. There is no straightforward analytic procedure to identify new possibilities, and pedagogical imagination could be as undisciplined as Benjamin's approach. One need not assume that small educational changes add up to huge social changes, but educational changes could still make a difference for some students.

Critique: an explosive concept

One cannot expect critical education, including critical mathematics education, to provide solutions to socio-economic and political problems on any larger scale. Education is hardly a world-changing institution. Still, this does not mean that educational fatalism is the consequence. Education might change something for some students. It might, in fact, change a range of life-worlds. Thus it makes sense within education to work for social justice and, in particular, to do so in an unjust society. Even knowing that the particular effort will not bring about a justice.

One element of modern conceptions of critique was a search for genuine foundations. However, Foucault demonstrated the critical force of a genealogy of knowledge which revealed foundational solidity as illusory. A genealogy, however, points back in time, while a discussion of the generativity of knowledge points towards the future. For critical mathematics education, it is important to formulate a critique not only in terms of a genealogy, but also in terms of generative investigations.

To include imagination as an important feature of critique is also important in moving beyond modern conceptions of critique. A pedagogical imagination is crucial for exploring educational possibilities. And one should not expect such explorations to be organised in any particular way or to be guided by particular methodological principles. They could, instead, take anarchic forms, as anticipated by Benjamin. Imagination is tentative; it is preliminary; it takes place in the open.

Critique must include generative as well as imaginative explorations. This means that the very notion of critique escapes being captured and nursed by well-intended definitions. Moving beyond the modern outlook means that critique becomes recognised as an open concept, a fluctuating concept, and a contested concept. In other words, critique becomes an explosive concept.

Notes

[1] For a presentation of critical mathematics education, see, for instance, Skovsmose (2011).

[2] A genealogy of 'social justice' will immediately bring us to Rawl s important study, *A Theory of Social Justice*, first published in 1971. Rawl represents a radical trend within the peaceful analytical approach. Further back in this genealogy we get to the works by Mill, Bentham, Locke and many others.

[3] For a general presentation of critical researches see Skovsmose (2009a).

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