

A GLANCE AT POSTMODERN PEDAGOGY OF MATHEMATICS

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Abstract. A cultural movement, no systematic theory, as a multiple ways of knowing so-called postmodernism (pomo) have been found in architecture, art, literature, sociology, communications, science, technology and philosophy since the middle of the twentieth century. We aims to represent a system of ideas, in a modern language, of pomo and postmodern mathematics in order to investigate some implications for pedagogy, without discussing the technical philosophy and mathematics.

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(I) Postmodernism (Pomo)

Pomo is a critique of modernism and a reaction to modernity, after that modernism was disappointed by the WWII (the atomic bomb) and the fact that human's longing for ultimate meaning has not been fulfilled by the progress brought by science.

Modernism is a period of history between the 16th and early 20th centuries emphasizing the following [HAM]:

- (a) **Unchanging Self:** There is a universal and unchanging self discovering all truth and to apply these truths to explain what it thinks and acts, and control over everything.
- (b) **Reality :** There exists an ultimate reality which is "out there" for everybody to discover.
- (c) **Certain Objective Truth :** Truth produced by science has been oriented by a desire for the certainty and absoluteness and objective (i.e. viewed and analyzed from outside the flux of society and personality).
- (d) **Reason :** Reason is the ultimate judge of what is true, what is good, what is right and what is beautiful.
- (e) **Rationality :** Superstition is replaced by rationality which is the way of organizing knowledge.
- (f) **Universality :** Science could produce general laws.
- (g) **Transparent Language :** Language is regarded to be transparent and to represent the perceivable world.
- (h) **Progress :** Science will eventually free us from our vulnerability to nature and will always lead toward social betterment.
- (i) **Order :** We live in an ordered world and that disorder is the result of bad theory, poor instrumentation and observer error.
- (j) **Mathematics :** Mathematics is an infallible, indubitable, perfect, certain, precise and absolute tool for exploring what constitutes the nature of something.
- (k) **Nature :** Supernatural is rejected.
- (l) **Natural Sciences :** Tradition is replaced by natural sciences .
- (m) **Logic :** Religious authority is replaced by the logic and scientific method.
- (n) **Secularism :** Knowledge must be free of religious orthodoxies.

Being beyond modernism, it is called postmodernism. To Habermas, however, postmodernism is "antimodernism".

Pomo has such features as the tolerance of ambiguity and disorder, stress on skepticism and nihilism, the mixing of styles and manners, rejection of all dualisms, lack of determinism and dogmatism, acceptance of change and chaos, stress on the constructedness of reality, sceptsis of certainty, emphasis on fragmentation of the world, and reaction against a naive and earnest confidence in progress. [SAL1]

"The movement by which, not without effort and uncertainty, dreams and illusion, one detaches oneself from what is

accepted as true and seeks other rules -- that is philosophy. The displacement and transformation of frameworks of thinking, the changing of received values and all the work that has been done to think otherwise, to do something else, to become other than what one is -- that too is philosophy.... It is understandable that some people should weep over the present void and hanker instead, in the world of ideas, after a little monarchy. But those who for once in their lives have found a new tone, a new way of looking, a new way of doing, those people, I believe, will never feel the need to lament that the world is error, that history is filled with people of no consequence, and that it is time for others to keep quiet so that at last the sound of their disapproval may be heard. "

[FOU1, P. 330]

Because pomo is rejection of ideas and values, it seems that there is not any definition of this term. We could however give some "principles" of pomo as the following:

1. There is no ultimate reality.

Pomo rejects the Cartesian ideal that objects are whole, discrete and bounded, and that the external world objectively exists and can be studied. It enforces the belief that we can create reality for ourselves, so-called simulacra as copies for which there are no originals such as computer simulations, mass media images, popular cultural signs and computer games, accordance to our needs, interests, prejudices, and cultural traditions. Photoshop is, for instance, a postmodern computer software in which photos such can completely be altered that "reality" is disappeared.

In an educational context, a simulation is a powerful technique that teaches about some aspect of the world by imitating or replicating it. Students are not only motivated by simulations, but learn by interacting with them in a manner similar to the way they would react in real situations. In almost every instance, a simulation also simplifies reality by omitting or changing details. In this simplified world, the student solves problems, learns procedures, comes to understand the characteristics of phenomena and how to control them, or learns what actions to take in different situations. In each case, the purpose is to help the student build a useful mental model of part of the world and to provide an opportunity to test it safely and efficiently. [A&T, 119]

Knowledge is neither eternal nor universal since reality, being a such cultural construction as music, poem, myth, etc and being open to criticism, changes over time and from community to community. Knowledge is a representation which is not truer than the other representations. The concepts, theories and methods through which we describe the world is socially constructed, and they are accepted for social reasons rather than because they are in any objective sense true.

2. There is no absolute truth.

There is nothing as an intrinsic nature behind everything which can be represented as an absolute truth, there is only interpretation. According to Foucault, knowledge and power cannot be separated, since knowledge embodies the values of those who are powerful enough to create and disseminate it [FOU2, P. 11-13]. There is no one knowing more than others, specially there is no expert.

The knowledge refers to probabilities and adventurous universe rather than certainties. There is no a-priori dogma. Lyotard even noted that everything that is received "should" be suspected [LYO1, P.12]. Postmodern science is ambiguous and unstable and is changing over time according to alternative interpretations given to it by individuals and language, which is no longer tied to fixed concepts and moreover denies any correspondence between language and the world, is adapted to this "play" of interpretation. It is not a mirror of nature, rather it is literally chaotic, uncertain, irrational and subjective.

3. Rejection of grand narratives.

Pomo rejects grand narratives or metanarratives (big ideas like god, individual freedom, truth, reason, history, and stories like Freudian, Marxist and Darwinian theories, and myths in our religions which give sense and direction to life) serve to mask the contradictions and instabilities that are inherent in any social organization, but favors personal narratives or "micronarratives", i.e. stories that explain small practices and local events, stories that you don't need to prove them in order to assert that they are true [KLA]. Moreover how the world and its components operate.

4. There is no base for moral.

In postmodern understanding, there is no base for moral. There is no standard, no objective and no universal moral law or value. Any moral law is relative to a localized narrative. Morality is a human construction.

5. Deconstruction.

Methodology of pomo is deconstruction. It emphasizes negative critical capacity and looks for such oppositions as good-bad, truth-

fiction, science-myth, love-hate and so on. Its aim, in particular, is to show there are multiple meanings in a text (concepts, ideas and objects), there probably are texts which are absent, and there is no "right" interpretation of any text.

6. Plurality.

In postmodernism, knowledge has an essentially pluralistic character. Diversity, divergence, contradictory, and incommensurable interpretations contest each other without canceling each other out. It is appropriate to speak of "knowledges" or "multiple truths"

It also stresses on plurality of cultures, perspectives, meanings, methods, values, reasons and that no particular type "should" be privileged over others. This leads to the birth of a global culture, as a belief system which is unable to accept any of other belief systems as absolutely true.

7. Science as magic .

Postmodernism says that knowledge is constructed by human mind not discovered, and is contextual not foundational. From a postmodern perspective, science deconstructs metaphysical distinctions between order and disorder, between cause and effect, between subject and object, between reason and madness, between rationality and irrationality, between certainty and probability.

Postmodern science by concerning itself with such things as undecidable, the limits of precise control, conflicts characterized by incomplete information, fractal, catastrophes, and pragmatic paradoxes is theorizing its own evolution as discontinuous, catastrophic, non rectifiable and paradoxical.

[LYO2, P.60]

For postmodernists, as noted by Feyerabend [FEY], there is hardly any difference between science and magic. Postmodernism considers all types of knowledge with equal skepticism. Science is just another form of religion. (see [SAL2] for more details)

(III) Postmodern Mathematics

There are so-called absolutist schools in philosophy of mathematics which believe that mathematics is an absolute, certain, universal, and independent of humankind knowledge. These are (i) Logicism, the view that mathematics is a branch of logic; (ii) Formalism, the idea that any branch of mathematics can be axiomatized in a formal language (by a set of meaningless symbols and arbitrarily preassigned rules) as a complete consistent formal system, denying the role of experience; (iii) Intuitionism, a view in which to be true is to be experienced and mathematical entities are constructed through a finite process (inductively) of natural numbers (which are abstract a priori forms of our intuitions) without applying the law of excluded middle (i.e., the claim that every statement is always either true or false); (iv) Platonism, a school saying that mathematics is static and based on some transcendental abstract entities which are perfect, eternal, unchangeable, out of space and independent of humanity.

In contrast, conceptual change schools in philosophy of mathematics claim that mathematics is fallible, corrigible and a changing social product. Mathematical truths are never absolute and certain, but "should" be understood as relative to a background pre-assumed system, e.g. $2+2=4$ is not an absolute truth, since in the system base 3 modular arithmetic we have $2+2=1$. [ERN]

The most famous school in this direction is Humanism. Humanism is a recent view claiming that mathematics is a social-cultural-historical product based on what we can actually observe, fallible being done by fallible people, and quasi-empirical analogous to natural sciences. Mathematical truths are uncertain like any other truths. [D&H]

Although mathematical proof is being sought precisely because of the certainty it is ordinarily held to grant, constructing proofs of computer systems correctness again turns out to be no simple 'application' of mathematics. It involves negotiating what proof consists of. [MAC]

Postmodern mathematics to which humanism is compatible, has turned from abstraction to representation and from control to indeterminacy. Moreover certainty has become an unattainable idea. It is changing its style and its role in our culture. The mathematical objects are invented from the needs of science and life by humans, and have no sense beyond their cultural meanings. In 1930, Kurt Godel proved that for any large enough axiomatic system to prove consistency we must add further assumptions to the set of our axioms. In addition, as Lakatos showed, a mathematical proof depends on a set of assumptions which are assumed by humankind, not absolute certainty [LAK]. Hence any attempt to establish the certainty of mathematical knowledge fails.

Computers are transforming the way mathematicians discover and prove ideas. Investigators have proposed a computational proof that offers only the probability, not the certainty, of truth. Computational experiments, intelligently performed and analyzed, can yield

more results than the old fashioned conjecture-proof method.[ZAW]

Although scientists claim to be guided by rationality or logically defensible, the rules of logic are nothing but socially prescribed ways of thinking. Pomo emphasizes fuzzy logic as an approach to decision based on "degrees of truth" rather than the usual "true-false".

Fuzzy theory resembles human reasoning in its use of approximate information and partial truth. Hence it is ideal for controlling nonlinear systems and for modeling complex systems where ambiguity and uncertainty is common.

It seems that this concept is attuned to the fundamental teachings of Zen Buddhism.[KOS, P. 182]

Nowadays, a new spiritual aspect is revived, for instance in the New Age movement, a revival of interest in astrology and logic has lost its determinant role.

Postmodern implications for pedagogy

From a postmodern perspective, knowledge, and in particular mathematics, is dynamic and we "should" always rethinking and deconstructing our beliefs and tools, so there is an emphasis on criticism rather than evaluation. Knowledge is free from any dependence on the concept of objective truth, instead, our beliefs "should" constantly be expressed lightly and seen as temporary theories.[GEN]

Knowledge is characterized by its utility and is functional, i.e. we learn things, not to know, but to use them.

The significant point in pomo is how to see rather than what is perceived. The postmodern scientists are interested in "What might be" and "What could be".

In primary education we "should" try, as Rorty noted [ROR, P. 41-42], to inculcate citizenship, i.e. what children "should" do in order to become "good" citizens, learn social conventions and learn what they need for their everyday lives.

School classroom "should" be democratic and dialogical, in this mean that students "should" have a major say in how their learning is structured and "should" respect their values.

Students might see pragmatically how ideas are tailored to favorite values. Theories and basic concepts "should" be rooted in practical experiences using methods of electronic technologies and computer softwares. Students is helped to see that science and mathematics depend on culture and are changeable and that we are not searching for certain and universal truths. They confronted to many different point of views on an issue, applying for instance Internet which brings fragmented world and unstable experiences into our lives, but they are never asked to follow one of them because they are all relative.

The Internet exemplifies many of the key concepts of postmodernism. It is a rhizome made actual, where notions of self, power, gender, class, ideology, history, philosophy, community, and identity, are challenged, formed and reformed in a fluid environment. It is a place for exploring the paradoxes of reality and the limits of textuality. It is a space where multiple voices can be heard simultaneously or in unison. It is an entirely new medium for speaking, writing, publishing, for hearing and being heard, a medium which problematizes concepts of what is text and what is speech. [KAR]

Pomo emphasizes that teachers and students learning together, in particular teachers "should" help students learn how to learn A postmodern mathematics curriculum does not stress on axiomatic styles, rather emphasizes problem solving and may be contains intuitive explanations (representations), computer investigations, metaphors, iterative and recursive procedures, fractals (which are patterns revealing greater complexity as they are enlarged), catastrophes, chaos theory (which is the study of unpredictable systems and irregular and forever-changing complex systems). Postmodern mathematics education emphasizes surface instead of depth, chance instead of design, diversity instead of uniformity, dynamics instead of progress, non-Euclidean geometry as well as Euclidean geometry, category theory instead of Bourbaki's methods. This type of mathamatics is about and a part of our life; it is accessible and everybody could learn it and like it .

References:

- [A&T] Alessi, S.M. and Trollip, S.R.(1991) Computer Based Instruction: Methods and Development . New Jersey: Prentice Hall.
[D&H] Davis, Philip J. and Hersh, Reuben (1981) The Mathematical Experience , Birkhauser.
[ERN] Ernest, Paul (1998) Social Constructivism as a Philosophy of Mathematics , Albany, State University of New York Press.
[FEY] Feyerabend, Paul (1981), " How to defend society against science ", in I. Hacking(ed.), Scientific Revolutions , Oxford Univ. Press, pp. 157-167.
[FOU1] Foucault, Michel, Notes on the Power of Culture, in Politics,Philosophy,Culture .

- [FOU2] Foucault, Michel (1990) The History of Sexuality , New York.
- [GEN] Generation X, Definitive Influences on Today's Youth: Postmodernism, Available: <http://www.youth.co.za/genxthesis/ch2.htm>
- [HAM] Hamilton, Peter (1992) The enlightenment and birth of social science, Chapter 1 in Hall, S. A and Gieben, B., Ed., Formations of Modernity . Polity Press, 1992.
- [KAR] Karper, Erin, Internet Legislation, Postmodernism, and the Academy: Selected Connections , Available: <http://icdweb.cc.purdue.edu/~karper/projects/webresources.html>
- [KLA] Klages, Mary, Postmodernism ,Available: <http://www.colorado.edu/English/ENGL2012Klages/pomo.html>
- [KOS] Kosko Bart (1993) Fuzzy Thinking: The New Science of Fuzzy Logic, Hyperion. [LAK] Lakatos, I. (1978) Philosophical Papers , Vol.2, Cambridge Univ Press. [LYO1] Lyotard, Jean-François (1992) The Postmodern Explained , University of Minnesota Press.
- [LYO2] Lyotard, J (1984) The Postmodern Condition: A Report on Knowledge , Trans. Geoff Bennington and Brian Massumi, Minneapolis.
- [MAC] MacKenzie, D. (1993) Negotiating arithmetic, constructing proof: the sociology of mathematics and information technology , Social Studies of Science, 23.
- [ROR] Rorty, Richard (1990) The Dangers of Over-Philosophication- Reply to Arcilla and Nicholson , Educational Theory 40, no. 1.
- [SAL1] Sal Moslehian, Mohammad(2002), Science in postmodernism view , to appear in The Letter of Philosophy.
- [SAL2] Sal Moslehian, Mohammad, Postmodern mathematics , submitted.
- [ZAW] Zawadowski, Waclaw M. (1990) Postmodernism and Postmodern Mathematics in Schools , Unpublished paper contributed to the Mathematics Education into the 21st Century Project.

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