

Math Education through the Perspective of John Dewey's Proposals: a Possible Path?¹

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Abstract

This project has the main objective to discuss the relations and contributions of John Dewey's theoretical and philosophical thinking on math education. Looking forward to make questions and reflections about so old proposals, but in the same time so true nowadays that the North American Philosopher, Psychologist and Pedagogue John Dewey left us as a legacy is how the problem that will guide this article has been originated: which are the possible affinities of the Dewey's theory towards the education and the math learning inside Brazilian Schools? Dewey believes on distinguished principles for a significant education achievement. When developing math education focused on mathematical literacy, teachers need to think how to provide the students significant experiences connected to their daily routine, making possible pedagogical practices that permit student to build their own development. Then, we can comprehend how the Dewey's ideas can be so close to what we are looking for the current education, in this case, more specifically, to the math education.

Keywords: John Dewey, math education, mathematical literacy, knowledge building

1. Introduction

The North American philosopher John Dewey (1859-1952) was born in the city of Burlington, in the state of Vermont, USA. Accordingly with Varotto (2012), Dewey, since he was a child, has the opportunity to develop his autonomy and responsible attitudes, as his dad warehouse owner, believes that children should be already responsible for some family life tasks.

However, his perception of education was classified as uninspiring and disinteresting by himself. During his personal and professional trajectory, he demonstrated interesting for subjects that includes autonomy themes, where a person can live their own experiences.

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Through his proposals and theories, Dewey strongly declared that education needed new paradigms and orientations to be relevant not only to student but also to educator. In his book *Experience and Education* he discusses the need of a theory for the Progressive Education to be established. It is important to mention that Dewey points out Traditional Education characteristics that permit reflections about some rules imposition, the distance between the person involved in the process, the contents to be learned and also the method about how those contents will be explored:

The traditional scheme is, in essence, one of imposition from above and from outside. It imposes adult standards, subject-matter, and methods upon those who are only growing slowly toward maturity. The gap is so great that the required subject matter, the methods of learning and of behaving are foreign to the existing capacities of the young. They are beyond the reach of the experience the young learners already possess. Consequently, they must be imposed; even though good teachers will use devices of art to cover up the imposition so as to relieve it of obviously brutal features. (Dewey, 1938, p. 5).

It should be noted that the teacher in this education is the knowledge and moral values communication agent. That means that he is an active agent that detains the wisdom. "Learning here means acquisition of what already is incorporated in books and in the heads of the elders." (Dewey, 1938, p. 6).

On the assumption that traditional education owns a static teaching process, where what is explored is a finished content, the philosopher believes that the new education is freedom possibility and the student will live different practical ways in the learning process.

The main factor that guides us in this article is what Dewey proposes towards the experience needs. For the North American philosopher, experience is something that request actions, in other words, is the person having contact with distinct contents, with diversified knowledge acquisition and assimilation methods.

According to Ferreira (2011), experience is like a learning flow through our five senses (sight, hearing, touch, taste and smell) that interact with our cognition to assimilate knowledge. It is important to mention that Dewey declared that each person is unique. Consequently, experience will be absorbed in particular ways and will be conducted also in an exclusive format.

With so rich and significant proposals in the view, the question that will guide this paper is created: What are the possible affinities inside Dewey's theory for math education inside Brazilian schools?

Thinking about math as a science, we understand that it can bring abstract and also precise nature, depending how math is treated. Loss (2007) mentioned that math education was influenced by "modern math" in different countries during 1960 and 1970 decades, when the theories and abstractions were the focus on learning. However, this learning format was not efficient and new subjects and practices begun to appear. The writer affirms that problem resolution then became the focus on math education, using students' daily routine situations so they could build their own knowledge.

In math education, the current context that we face is that teachers look for change, as the learning methods are still anchored in traditional school system, according to Passos *et al.* (2009). However, the writers also indicate that many times, teachers desire changes to be happen and they find them alone in their aspiration for math approach transformation and this fact prevent changes happening inside the classrooms. And the students? How they perceive this subject? They can comprehend? Given some recent documents data (Brazil, 2014) it is fundamental to explore situations that daily routine provides and that are attached to math learning nature:

Taking advantage of students curiosities and explore situations and contexts is one of the didactic math tasks, beginning from culture and lifetime stories, experiences and previous knowledge of children. Create problems and organize them so students can mathematically think towards the issues and to the world that surrounds around them is much more than teach how to count or memorize figures names. Math is more than calculations and nomenclatures! Simple situations of counting can build rich contexts where children think and argue (Brazil, 2014, p. 33).

Inside this context, the current article wants to discuss John Dewey's general education contributions and relate his standpoints to math education. Dewey perspective will be contextualized, followed by a discussion about how should be math education aiming a significant learning manner.

2. The Dewey Perspective about Experience

John Dewey purposes, in different writings, as *Experience and Education* (1938) that education needs to be driven by experience. Experience is a step that belongs to nature, where two elements (situation and agent) interact between them and modify themselves, affirms Dewey (1978). The philosopher and educator describes the nature of the experience process, explaining that experiences could be little significant or can acquire a considerable significance. About experience process we can mention:

There is mutual activity and mutual capacity of reaction. Not being primary cognitive, this mutual adaptation could be purely organic, not involving modification perception that processes between agent and situation, and also the new agent and new situation after the experience. Experience in this case is little significant to human life. Not reaching conscientious reflection, experience does not provide any instrument that can make us better comprehend the realities around us. Greater will become this significance, when with perception, analyzes, research elements are completed, so we can acquire knowledge, that make us prepared to drive those experiences and new ones. (Teixeira, 1978, p. 16).

Besides, Dewey (1976) explains that not all experiences that person lives will educate in a significant manner, emphasizing that education and experience are not analogue processes. As unlearning experiences, the philosopher define them the ones that cannot allow the continuity on future experiences and to richer experiences and also experiences that develop student to mechanical practices, bringing them to routine and closing the doors to other experiences. It is important to highlight that Dewey is also concerned by the experience choice question that need to establish connection between experiences so that learning can happen and not only being enjoyable and pleasant. In this context, Dewey determines as fundamental role of the educator, to organize the student experiences, so them can enrich the learning and propitiate continuity of new experiences.

According to Ferreira (2011) experience as part of Dewey's proposal is one flow, where through the person senses, experience establish and expand appropriated models on actions. Very important in this context, to define the "rebuilding process and the experience reorganization, through which we strongly perceive our senses and with that we habilitate ourselves to better drive our own future experiences" (Teixeira, 1978, p.17), as education to John Dewey. Muraro (2013) emphasize education as a reflective experience, uninterrupted and conducted by thoughts, concluding as an education act method to teach how to think so the person can transforms the reality he is involved. So we can comprehend that education is the base to happen the transformation of the society we live, through experiences that are connected to each other, significantly, can provide learning and knowledge that person will develop reflections and can be critical towards various situations, not only inside school but also outside it.

But how we can implement experience based education, where student will change from passive to active, where traditional learning will be replaced by new education, as John Dewey proposed? In the writing *Experience and Education*, Dewey makes a deep reflection about traditional school. Discussing the experience question, the philosopher affirms that there are experiences inside traditional school, but those experiences are not totally positive, given the fact that many times they do not have connections with future experiences or even to student daily routine. Those experiences are limited to mechanical practices and because of that cannot develop critical people towards new situations; experiences that assimilate learning as something boring. Dewey words permit a new vision to pedagogical proposals that prevail in our classrooms, the traditional learning.

Dewey is not criticizing traditional learning, but he is proposing new educational bases that aim intense development of the student, turning them critical and reflective. Dewey proposes to shape theoretical bases to progressive or new education. However, to progressive education prevails in practice, there is a long way to go, that means it is not a simple step to be made. There is much criticism about the progressive school and the experience theory must be reorganized to drive education practices.

Relating to organization, Dewey explain that when we hear this term, we almost immediately remember traditional education, however educators called reactionaries by the philosopher, avoid any type of organization that resemble the typical organization of traditional school. In this scenario, Dewey suggests the experience theory to be established. Dewey affirms that progressive education is much simpler than traditional education, since progressive education follows a natural path and in accordance with development:

I admit gladly that the new education is simpler in principle than the old. It is in harmony with principles of growth, while there is very much which is artificial in the old selection and arrangement of subjects and methods, and artificiality always leads to unnecessary complexity. (Dewey, 1938, p.10).

According to Carlesso and Tomazetti (2009), Dewey's experience concept is extremely complex and to implement them in the schools is still a difficult task, where all the parts must be involved. The main question would be: Where this change needs to start?

Basing in Carlesso and Tomazetti (2009) again, we can affirm adults has a deep concern about children development. Children when went to school, they arrive there with their acquired daily routine knowledge, in other words, they bring with them diversified experiences that were built by dialogues made with adults and other children, by their child's play or by their lifetime experience:

The person who lives daily routine knowledge situations, with popular culture interaction, with common sense wisdom, in different moments of change, become responsible for "signification network" creation of each one. (Carlesso; Tomazetti, 2009, p.575)

Dewey proposes to provide new apprenticeship and new ways to think beginning from knowledge that the student bring, where experiences will allow construction of knowledge expansion. In the writings "The child and the curriculum" (1902) and "Interest and effort in education" (1913), Dewey make reference about the child inclusion in the school. The child is removed from his little familiar world and forced included in a new world, where need to learn all subjects contents in a fractional way, having rules that are imposed and they are obligated to assimilate them.

About the kids' interest, the philosopher confirms that we must create a condition so the interest can be created. The teacher should perceive the child needs, developing an environment full of resources that cognitive operations will be driven and then the interest will be manifested naturally. So we can understand that Dewey's main concern is the experience based education "is always the current life experience of the person" (Teixeira, 1978, p. 95). In addition, John Dewey insists that children and society urgently need a pure and simple education, highlighting that we must know what education is and how we can implement it.

It is very impressive the modernity behind Dewey's words, his brilliant vision and inquisitive in the same time about the pedagogical practices, that is exactly the context explained by him where we can find our current situation inside Brazilian classrooms and maybe all over the world.

But only through significant experiences we will have new and better results in current education? Dewey declares firmly that not only conservatives but also radicals are not content and they look for changes. To Ferreira (2011) John Dewey brings a plausible alternative to the current scenario:

John Dewey proposes an alternative option to a problem; experience now is intrinsic linked to cognition and actions taken.

This appears to be the great naturalist contribution in the current debates; the interaction mind/body gives place to interactions person/environment permitting a wide dynamic cognitive comprehension. The interaction problem between two distinct substances is then replaced by awareness towards person experience dynamism and his knowledge progress (Ferreira, 2011, p.175)

Nevertheless, Carlesso and Tomazetti (2009) do not contemplate these situations in a simple manner. The writers affirm that Dewey concept assumptions are very present in the current pedagogical issues. But they emphasize that is missing theoretical fundamentals so teach can implement those proposals. Accordingly, a better appropriation of the concepts needs to be created so the proposals can go from superficiality to reality.

3. Math Education through the John Dewey's Proposals Perspective: a Possible Path?

Discussing about which path education in general needs to take, we have another subject to study: the math education.

Math is everywhere inside children daily routine in general, before they perceive math real significance. Since babies, parents explore math with their children and they also do not perceive it. When parents are talking with the baby or the kid, the parents say: "I will put one sock in this little feet"; "take one doll for me". In other words, the relation between numbers and objects is already being implemented before the children perceive the speech and language development.

Children since too soon have contact with numbers in their daily routine. Kid is exposed to different ways of using numbers inside the family environment. He sees numbers expressed in everywhere, as calendars, telephones, house numbering, shoes and cloths numbers, numbers written in food products boxes, and so many other ways of numbers expressions. There are also the numbers that can be said, like age, weight, time, price and many others. Those kinds of expressions can stimulate the numbering representation scheme. That is a creation established according with their experience. However there was not real creation of numbers (Mattos, 2008, p.92).

Using the experiences that children bring from home, the teacher develop a work proposal that stimulate curiosity and pleasure around math, assuming a pedagogical practice based on Dewey's education proposal. However, Carlesso and Tomazetti (2009) pointed out that is critical the use of students experiences on teaching, it cannot be simplistic and need to be deeply understood.

And when children go to school, how the mathematical alphabetization and mathematical literacy happen?

Nowadays, it is known that kids do not get into school without any mathematical experience, and to develop a proposal that promote some intuitive ideas on kids, their language and needs of intellectual development, request much more than just try to make the student to repeat a number sequence. (Smole, 2003, p.62).

We need firstly to define alphabetization. Based on Magda Soares (2004), alphabetization is the writing conventional system, distinguishing from literacy, which is the capacity and behavior development in the use of reading and writing inside social practices. The writer also reports that literacy is a very recent term and many times it is confused with alphabetization, but alphabetization is one piece of literacy.

Inside a new and differentiated context, children will learn math in a playful and pleasurable way through experiences that already are part of their daily routine.

The infant thoughts development and mathematical literacy could be worked in different ways: with games, child's play, imaginary situations, reading a story and other situations. Knowledge providing through the activities just proposed, make us reflect towards experience based education, very well outlined by John Dewey.

Surely, to this new way of education happen we need investment on teachers training, beginning with studies, discussions and reflections. All those options will permit a solid base consolidation to implement Dewey's proposals.

However, Megid (2009) in her research developed inside a training classroom for people that would teach math to the first years of the Elementary School, reported that a hard work is necessary so the pre-judgment that are part of school routine can be abandoned, in other words, the teacher were students one day in the past and many times they teach in the same way they learn. The writer gives us an example related to math very pertinent to illustrate this context:

The fundament arithmetical operations algorithms were taught and could be never questioned. That is not only an invitation to change the way we make subtractions, there is a need to create a problem, analyze it and question those practices, so that we can project other practices. Considerable effort will be needed to those actions occur and also a lot of reflections and discussions inside the classroom (Megid, 2009, p.117). When we analyze another research described by Carlesso and Tomazetti (2009) that was realized with a Preschool and initial years of Elementary School teachers, questioning if experiences based knowledge was possible and which experiences were those, it was possible to perceive that there is a lot of work to be done in this way. The writers analyze that from some teachers reports they understand the need to recognize experiences, however they show a superficial understanding.

According to interviews, the great majority of teachers point out the importance of highlighting experience and it rebuilding in the school, but without proper ownership. There is a tendency to oversimplification when some discussions advance to give example of situations, or to explain some concepts of what experience is and how it can happen inside the school. The great majority of the interviewed teachers said that experience contemplate the kids socialization, and is associated with interactions that it can make with the environment they live. This comprehension is limited comparing the relations with experience through cognitive development, possible to be present in the person knowledge building, as Dewey points out (Carlesso; Tomazetti, 2009, p. 581).

In November of 2012, the Brazilian government created the National Pact for Right Age Alphabetizing, known as PNAIC (Pacto Nacional de Alfabetização na Idade Certa) based on the interim measurement nº 586. Objectively, the PNAIC aims to full alphabetizing not only in Portuguese but also math, eight years old kids of the third year of the Elementary School. However, it is very important to mention that the pact proposal was not only to make students know how to read and write in Portuguese or in math, but to develop literacy. Analyzing PNAIC documents, it is very clear the concern about a pedagogical work beginning with the information lived by children routine, letting them act actively on developing new knowledge:

[...] detail two fundamental assumptions to the pedagogical work with kids in this age: the playful role and the need to interact with the child universe, respecting their way to think and their knowledge building process (Brazil, 2014, p.9).

The National Pact for Right Age Alphabetizing (PNAIC) wants to provide transformations in the way teachers transfer the knowledge, one of its objectives is to permit a new vision over the knowledge building process. Are that the same main reflections proposed by Dewey? To learn, "not only codifying and decoding mathematical symbols, but also to ask questions, create hypothesis, validate them and justify procedures" (Brazil, 2014, p.5, notebook 1) are the PNAIC proposals.

Concluding, we can identify that there really are some concrete concerns related to pedagogical practices and it is being offered to teachers a new vision over teaching and learning systems. The PNAIC is one path to transform students' knowledge building, aiming to modify the teacher role inside this process.

4. Final Considerations

The education contribution we find inside the John Dewey legacy is surely essential. From significant contexts that are part of the students' routine life, teachers can create a more interesting environment easier to develop knowledge. However, worrying about students' daily experiences is not enough, the experience based education explored by Dewey is much more complex and require a considerable effort from the school, teacher and student. The path to be followed is not easy and cannot be improvised, as declares John Dewey.

As the main objective of this text to tersely discuss the Dewey concepts, and the possible relation with Brazilian Schools' math teaching and learning methods, we can conclude that the John Dewey proposals are extremely modern and pertinent to current context we find in our schools. Student with few or none interest and teachers assuming an active knowledge transmitter role illustrates the current scenario. As we discussed throughout the text, radical and conservative educators look for changes.

Concluding, we can transform pedagogical math education proposals based on Dewey's concepts, but we need to deeply study the philosopher, as mention Carlesso and Tomazetti (2009), understanding him so that his proposal do not be oversimplified with wrong concepts. Experience based education will develop a math learning free of procedures that are anchored in abstractions, permitting students to comprehend math in a concrete manner attached to the routine inside and outside school. Additionally, making mistake is essential to build solid knowledge and all the meanings and values already acquired by the student must be taken into consideration for new knowledge and consequently new experiences acquisition.

Acknowledgement

Educating is like growing, not only purely in the physiological way, but also in the spiritual and human way, making life even larger, richer and more beautiful, in a world increasingly adapted, more propitious, more beneficial to mankind. (Teixeira, 1978, p.17)

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