Rev. Innova Educ. (2020). Vol 2 No 2 pp.226-244

Revista Innova Educación

www.revistainnovaeducacion.com

ISSN: 2664-1496 ISSN-L: 2664-1488

Edited by: Instituto Universitario de Innovación Ciencia y Tecnología Inudi Perú

Mathematical literacy in university professionals: impossibility or urgent re-significance

La alfabetización matemática en profesionales universitarios: imposibilidad o re-significación urgente

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DOI: https://doi.org/10.35622/j.rie.2020.02.001

Received **27/01/2020**/ Accepted **11/04/2020** Published **26/04/2020**

ORIGINAL ARTICLE

KEYWORDS

mathematical, literacy, re-signifying, university, professionals

This article studies mathematical literacy in university professionals as an impossibility or urgent re-significance from the voices of different professionals. In the investigation, interviews were conducted with nine (9) professionals from different areas. Through a qualitative inquiry, an exploratory study, thereby becoming emergent categories. The results reveal the analysis of the emerging categories surveys such as: democratization of mathematics; intellectual laziness in professionals; bad educational policies in Venezuela; false beliefs, negative emotions towards mathematics and imposition of a reductionist mathematics in the classroom and the meeting of the scientific knowledge of mathematics and the underground knowledge of it. In conclusion, mathematical literacy currently has in the professional exit lines such as: the professional promoter of mathematics as a legacy science of humanity, as the citizen responsibility of each one; minimization in communities of learning of the false beliefs of mathematics and its learning, we can all; the democratization of mathematics and re-signified educational policies in favor of the promotion of the legacy science of humanity. It encourages us to think that the problem and then the need today more than ever for mathematical literacy is everyone's responsibility.

PALABRAS CLAVE

alfabetización, matemática, re-significar, profesionales, universitarios

El presente artículo estudia la alfabetización matemática en los profesionales universitarios como imposibilidad o re-significación urgente desde las voces de diferentes profesionales. En la investigación se realizó entrevistas a nueve (9) profesionales de diferentes áreas. Mediante una indagación cualitativa, un estudio exploratorio, deviniendo con ello categorías emergentes. Los resultados revelan los análisis de las encuestas categorías emergentes como: democratización de la matemática; pereza intelectual en profesionales; malas políticas educativas en Venezuela; falsas creencias, emociones negativas hacia la matemática e imposición de una matemática reduccionista en el aula y el encuentro de los saberes científicos de la matemática y los saberes soterrados de la misma. En conclusión, la alfabetización matemática tiene actualmente en las profesionales líneas de salida como: el profesional promotor de la matemática como ciencia legada de la humanidad, como

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responsabilidad ciudadana de cada uno; minimización en comunidades de aprendizaje de las falsas creencias de la matemática y su aprendizaje, todos podemos; la democratización de la matemática y las políticas educativas re-significadas a favor de la promoción de la ciencia legado de la humanidad. Nos incita a pensar que la problemática y luego la necesidad hoy más que nunca de la alfabetización matemática es responsabilidad de todos.

When I study mathematics, my thoughts rise to the universe, and its similarities of perfection with this one make me understand the most beautiful poem of life itself; I think I vibrate in that shelter that when I can be in the most beautiful stasis when feeling your Holy Spirit.
Milagros Elena Rodríguez (2018: 40)

1. INTRODUCTION, ART STATE, CRISIS, JUSTIFICATION AND THEORIES

I don't want to know anything about numbers, truth is, I chose my current career just to not know anything about Mathematics. This are words frequently uttered by professionals who openly admit their ignorance for the most elemental mathematical concepts, and their rejection to learn them.

The mathematical attitude that shows the confidence in the use of Mathematics, the interest, curiosity and inventiveness to do Mathematics and value the practical use of mathematics in daily life is scarce in many professionals, who, deliberately or not, propagate such reality in their own lives and with it, they feed the wrong beliefs on what really mathematics, its learning and teaching, are. The absolute impertinence in which those professionals who enjoy the scientific development with great contributions of Mathematics and demystify its usefulness.

In general, Mathematics is a science of which results are used in daily life contexts. In the case of professionals, there is no area of knowledge that does not have any relationship with Mathematics. It can be said that any professional who has no basic mathematical knowledge or essential mathematical competences, cannot practice as such. Their critical and abstract thinking is not competent regarding the high complexity needed in these globalized and competitive times.

About transdisciplinarity, the 4th article of the Transdisciplinarity Charter, signed in Arrábida, affirms that "the key to the vault of transdisciplinarity resides in the semantic and operative unification of acceptations through and beyond the disciplines" (Basab, 1996, p.25).

Now, "the digital literacy or culture of all individuals becomes indispensable not only in the processes to identify dilemmas or disciplinary problems, but also in the search of information, representation, exploration, problem solving and results communication" (Santos, 2015, p.145).

We can consider literacy here as a complex concept, that not only relates to competences and abilities; but to think in a complex way. Hence, this especially helps, in the educative context,

to gather, unite, construct and relate pieces of knowledge, which are permanently changing, just as it's explained by Morin (1994).

In the case of Mathematics, thinking it as a complex concept, the pedagogical practice of Mathematics must, according to Rodríguez (2019) contribute, through a mathematical content, to the training and integral development of people, making sure they get deeply involved in their own training, motivating and stimulating them with the goal of being educated as such, and not as if we were making and programming *machines*, which makes them forget the classes of mathematics, exerting mechanism of power that increases in the students, even more, the feeling of rejection and predisposition for such science.

So, the point of view addressed above, being complex, forbids the student to realize that the inherent characteristics of mathematical knowledge are especial, because they lead them to foment creativity, critical thinking, the ability to learn in an autonomous way of what they need in and for life, and to apply such notions to tackle the problems that life could bring. All of this is possible with an adequate and pertinent teaching of Mathematics, Morin (2006).

Consequently, parting from the idea that Mathematics education, literacy and thus the mathematical literacy, are complex processes, "the mathematical literacy is configured through a basic repertoire of knowledge, techniques and mathematical skills which a series of abilities and competencies constituted on the base of the use of such repertoire in daily life experience, must be added" (González, 2018, p.11).

From my own experience, in my calls for the urgent mathematical literacy, in many speeches, and conferences, I have found opinions from mathematicians like: it's time to work in aiming our research efforts to the development of our country, and find our own results and not depend on an article as well, it's a task of us all to socialize the importance of mathematics in the daily life, in the popular knowledge, in the development of human being, and to achieve that, we must study its origins, its structure, in order to understand its language and apply it.

The consequences of being illiterate in mathematics, is of an extreme seriousness, and when found in professionals, it is unbelievable. That tells us that the curriculum and college training are not designed according to the precepts of transdisciplinarity of knowledge. Without this knowledge – the mathematical knowledge, if such professionals tries to understand the meaning of a scientific argument, most probably, they would misinterpret its content, or would not understand it at all. This is also true, but "it's a truth that can be found half the way to indolence" (Fehr, 2011, p. 69).

In the Programme for International Student Assessment (PISA), the Organization for Economic Co-operation and Development (OECD), conceptualizes the mathematical literacy as

the ability to "recognises the role that mathematics plays in the world in order to make well-founded judgments and decisions needed by constructive, engaged and reflective citizens" (OECD, 2003, p.3).

The definition above is clear; if the professionals were well centered in relation to the legacy of mathematics in mankind and in their own careers, they would collaborate to the urgent and necessary mathematical literacy in the lives of their students in general, and in the lives of the people they routinely work with. That, and considering the role they have before the world, as citizens.

The mathematics democratization, a concept related to mathematical literacy, should be part of "an effort to ease the inequalities in the access to educative opportunities in support of a society that favors the democratization of knowledge – any knowledge; taking into account what people know and want to know" (Palma, 2018, p.111).

This democratization would contribute to change the current negative view of some students and professionals towards Mathematics, and in a future, prevent the intellectual laziness of some citizens and the sloppy interest towards Mathematics.

The intellectual laziness towards Mathematics prevents professionals to develop essential competencies. Consequently, they teach science the way they were trained, so they continue seeing Mathematics as hard and unreachable, and with that, they have undervalued Mathematics legacy to humanity. Such, is what we will attempt to research here, what is the interest of Mathematics some professionals from different careers have, and why. Note that this intellectual laziness is, most of the times, caused by the constant rejection towards Mathematics, since most of the professionals know its importance and its applicability. That's why, in this exploratory research we will study opinions and the answer to this question: *What is the reason that the elemental mathematical needs are not covered by professionals (of different areas); on the contrary, even if aware of the importance of Mathematics, they still promote its rejection?* The methodology applied in this research is explained below.

Mathematics for all is increasingly more urgent than ever, it is not only about professionals being scientists or experts of this *legacy-science*, but bearers of skills and reasonings that are applied in their jobs and daily life. It is about a political dimension of Mathematics under the service of mankind, a task we cannot rely only to mathematicians.

Rico (2007) emphasizes how mathematics is everywhere, in any process. He explains that each natural phenomenon is a manifestation of change; the world around us shows a multitude of temporal and permanent relationships between phenomena, i.e. the changes of living organisms as they grow, weather changes, the tides of the seas, the cycles of employment and unemployment,

even the economic changes. Some of the processes of change can be described and modeled using mathematical functions directly: lineal, exponential, periodic, discrete or continual. The mathematical relations usually have the form of equations, but they can also represent the most basic relationships in natural phenomena. The human body and its functionality, its processes and perfection, are all mathematical.

All of what was addressed above, and even more, have their mathematical content, which must be of interest to everyone. Understanding about their generality: it surprises us that someone does not know the most basic history about their countries, about the political division of their states, or municipalities, even their mother language. Thus, it must surprise us that the most elemental mathematical processes of daily life, are ignored as well. Especially when this ignorance is promoted by professionals who, having an animadversion towards Mathematics – perhaps for personal reasons not overcome, in their professional settings and their own families.

The idea of Mathematical literacy could be understood as the ability of an individual to formulate, use and interpret Mathematics in a variety of contexts. "It includes concepts, procedures, facts and tools to describe, explain and predict phenomena." (OCDE, 2013, p.25).

We can come about the crisis in the teaching of Mathematics, which continues being done as an exertion of power in the classroom. Rodríguez (2018) have been pointing out that teaching is an art that implies intimal interactions with others, where feelings, emotions and mood, the self and the life of all involved in the educative process are intimately united in their educative labor. The teaching of Mathematics is not stripped of this reality. Society, as a whole, must understand the urgent need to show a *living* Mathematics, intertwined with the dialogic processes in the life of the human being.

However, the art state of the problem of teaching of Mathematics is still in crisis. Rodríguez (2019) explains that in the classroom, narrative situations of imposition take place: "I explain, and you copy!", "Repeat the procedure as such!" "You must change nothing!", "this algorithm is this way and so you must repeat it!", "Only a few can pass this!", "you love change things and get confused!". Then, a sudden silence in the room. The class time is over and so it ends the communication in a Mathematics class. These are stories and phrases so frequently repeated, even in this technological era.

Hence, even in this era, we still conclude that the school failure in Mathematics is a persistent problem, "and with it, the potential exclusion of many students to join their desire for Mathematics. It's like if the wish of expanding the reach of more Mathematics for all, generates mechanisms of selection and exclusion of many!" (Valero, 2017, p.90). all of this, with the results already exposed, Mathematics is still promoted only to a few considered "smart".

The risks and costs of the Mathematical illiteracy have been widely studied. In 2018, the Semana Magazine analyzed the topic, concluding that "Even though mathematical illiteracy makes people's daily life harder; its consequences are also global. Many studies suggest a correlation between the lack of arithmetic skills with unemployment, productivity and even health."

What follows to the development of this research: methodology, goals, research tools, categories and research development; the former tackles how mathematical literacy is seen from the interviewees' point of view, the analysis given by the interviewee when they were asked the question formulated in the beginning of this research and finally, the conclusions and the questions that motivate to continue studying this problem.

2. METHOD, OBJECTIVE, CATEGORIES AND RESEARCH DEVELOPMENT

The objective of this research was to study mathematical literacy in professionals as an impossibility or urgent re-significance from the voices of different professionals and the emergent category analysis which arose from their opinions.

In this research, nine interviews were performed to professionals from different areas: Mathematics teachers, mathematicians, physicists, psychologist, chemists, and accountants. The instrument used was an unstructured interview, which does not need validation. The election criterium was free, except the only requirement for them to be professionals from different areas and be willing to answer the only open question which will be specified below:

Throughout an qualitative research, in an exploratory study, participants' opinions are analyzed according to their answer to this question: *What is the reason that the elemental mathematical needs are not covered by professionals (of different areas); on the contrary, even if aware of the importance of Mathematics, they still promote its rejection?* Once the most important ideas that contribute to the topic, were extracted, i.e. mathematical literacy in professionals, their contributions to the emergent categories that come out from their opinions. Later, taking into account all what was previously addressed, recommendations to attempt to ease this crisis are given.

Some emergent criteria on mathematical literacy analyzed from the voices of the interviewees are given below:

Mathematical literacy in professionals: the voices of the interviewees

From the question: *What is the reason that the elemental mathematical needs are not covered by professionals (of different areas); on the contrary, even if aware of the importance of*

Mathematics, they still promote its rejection? The most important ideas of each interviewee are selected below. These ideas are defined as emergent categories.

Emergent category: the democratization of Mathematics

Interviewee 1, a mathematician, affirms: "it is time to aim everything we have researched towards the development of our country, and to find our own results to not depend on an article of reference. It is a task of all to socialize the importance of Mathematics in the daily life, in the popular knowledge, in the development of the human being and in order to achieve so, we must study [Mathematics'] origins, structure, to understand its language and apply it."

More than a criticism towards the current situation and crisis of mathematical literacy, *interviewee 1* contributes to the category: the democratization of Mathematics that corresponds to the specialist of this area. He acknowledges the existence of the Mathematics for scientists – like Mathematicians, which is abstract and indispensable; but he also looks forward the reinvention of such science in the daily life of the human being, for they to conceive this science as a language and tool in their own development and its applicability in the daily life and most important needs of the human being.

The human being trained in a university setting must have the competencies and abilities to show how they would portray their daily life as they see the world, bringing solutions and managing themselves as citizens of this world which they owe so much. No professional should turn their back to the problems of this world, since they come from it and owe to it.

Emergent category: intellectual laziness in professionals

Interviewee 2, a Mathematics teacher, says that: "I could say many things, but this is our fault (…) since it is easier to not make any effort, to excuse ourselves for not having any abilities, magnify those who work harder, than thinking by ourselves (…) we take for granted that we would never need Mathematics, that with the knowledge of addition and subtraction is enough (…) Why making big efforts in the end? We have been always cheated by the clerk in the supermarket, in the convenience store in a simple calculation, or sale; the government with their laughable raise (..) and in this state, we will spend the rest of our lives, with what we deserve, literally, because we're lazy, for seeing ourselves so tiny that it is better to steal from others rather than learn Mathematics and help ourselves with it."

This intellectual laziness is present, currently, even though the technology we use, the globalization and the expanded possibilities to get knowledge. The established conformity in our

minds, either because we learned that Mathematics is used for specific purposes, that we cannot learn it; or that specialists exist to solve the problems.

Form the setting we work, including the academic institutions; we have set Mathematics apart, distorting its usefulness; even the most basic arithmetic calculations are made only with electronic devices. Ignoring that the Mathematics helps also in the development of critical thinking, abstraction, assertiveness and even our own language enrichment. These are some of many nouns we could Transdisciplinarily apply to our training and stop to bring the sciences apart from Mathematics, and use it as a mere tool.

Emergent category: Venezuelan bad education politics

Interviewee 3, a professional accountant, thinks that: "the elemental mathematical needs that are not covered by professionals is fault of the governments that we had had in Venezuela, since I have seen that a mere high school graduate gets an important seat in the government because they have friends in high places. I don't agree on keeping the rejection of Mathematics by out fellow professional in the area (…) in this particular case, if the professionals reject Mathematics, they do so because they do not like them."

This is a sensitive topic to study, and maybe this would deserve a continued research in another paper to understand how in this country, Venezuela, Mathematics, as a basic science, is set apart from the curriculums in recently created universities; even in careers like engineering, we observe that Mathematics, as a subject, is far from being good.

The politics of the government have not achieved to elevate the academic level or our public education, among other causes, because we lack of an apt discrimination of the teachers body in our institutions, and as a consequence, many teachers are hired by political reasons, especially because of the scarce numbers of professionals available caused by emigration and poor salaries. In many universities – if not all, there are not any departments of Mathematics as structures which could have a convincing role in the teaching of Mathematics, in its planning and quality control. The researches of our Mathematics professors are not applied, what is more, many of them do not research about their own praxis in the classrooms, in order to evaluate themselves and improve; the opinions of the students are not taking into account for the reconstruction of the classroom.

In many cases, in primary school, the ones in charge to the noble task to teach Mathematics, are not specialists, nor trained to teach it. In Venezuela, "the community of teachers of Mathematics, increasingly make major contributions with their researches done in campuses and research centers, and postgraduate courses; of which results, unfortunately, do not reach the

governmental instances. It is precisely this lack of link that suppresses any possibility to extrapolate their findings to the great conglomeration in secondary and primary education" (León, 2016, p.455).

In this order of ideas, the wrong Venezuelan educative policies that affect in the teaching of Mathematics in all levels, Cordero (2019) affirms that one of the causes of the lack of effectivity in such policies, is the deepening of the structural problems of the Venezuela educative system; and the permanent training of teachers as well. The new tendencies, in transdisciplinary collaborative learning, among others.

Cordero (2019) keeps on endorsing the complexity and transdisciplinarity as continuant categories of research, he says we must part from the complexity as a system of fluid education, with the integration of educative and non-educative contexts, along with direct and indirect participants from the Venezuelan educative sector. To conclude, according to Cordero (2019), there is not agreement yet on how to canalize the educative policies facing the new Millenia of the stable and unstable.

Emergent category: false beliefs, negative emotions towards Mathematics and the imposition of a reductionist Mathematics in the classroom

Interviewee 4, a young Mathematician believes that "the rejection (to Mathematics) is generated for the fear to the unknown. When you talk to high schoolers, they claim they do not know what they're doing. It looks like the system is designed in a mnemotechnic way, so you can only know how to apply the algorithm, but not to discuss the results beyond the numbers; a situation that might change once they get to the university. But the taboo is already established. If we want an idea to be accepted by many, it must be explained in a way that can be understood by the commoner."

In relation to this, the next interviewee coincides with the category we're currently analyzing. The interviewee 5, a professor, PhD in education, opines that "the belief that Mathematics is only deserved by gifted people, is still hold, that its study is too hard and complicated."

Interviewee 5 adds that "the study of Mathematics generates anxiety, nervousness and anguish because of the so wrong ideas many professionals hold about it. In the same way, I observe a bad training even in some teachers in the area [of Mathematics]."

Interviewee 6 says that "the rejection towards Mathematics is instilled from younger ages, whether at home, or in the school. At home [it is instilled] by ignorance, when they tell you that

addition and subtraction are enough and, in the school, because they use Mathematics as a punishment for 'behaving badly, you must write the numbers from one to 2000.'"

Interviewee 7 affirms that "maybe it is caused by the way Mathematics is addressed from a rigid point of view when it is taught. Students in general tend to have better grades in the subjects they like, so in some way, the interest [in Mathematics] have been lost, hence its importance it deserves is downplayed."

Observe how interviewees 4, 5, 6 and 7, broadly summarize the causes of the scarce mathematical literacy in professionals to the false beliefs, negative emotions towards Mathematics and the imposition of a reductionist Mathematics in the classroom. The beliefs and attitudes towards Mathematics have been studied long ago. In Rodríguez, Velásquez and Lemus (2019) the emotional dimension must be essential in the process of Mathematical learning, and it can be addressed from the psychological and sociologic perspectives. The relationships between Mathematics and the emotional dimension are not easy, and they require a teacher trained specifically in the aspects concerning the areas of psychology and sociology within the education of Mathematics.

The State and the society as a whole must collaborate in uncover such veil, which can be seen as a negative shadow that has been sowed in the people and in Mathematics, a World Heritage science. It is time for everyone to collaborate towards the idea of Mathematics as the human creation it is, and so, the human being can understand it, recreate and magnify it together with the rest of the sciences in a fractal Mathematics that is complexed with other areas that the human being has forged. Of course, there's a vail of mathematical mystery in Nature and in the creation of mankind, which deserves a research, since it has been concluded that God is a mathematician. A well-deserved honor.

It is worthy to emphasize that in this emergent category, the educative policies in Venezuela are not designed to minimize the false beliefs and the mechanical way to teach Mathematics. This is a topic to be addressed by specialists, in order to democratize Mathematics in the classrooms and in the streets, in the daily life of the citizens. This is also a call for the publicity in general, in any globalized media, stop using Mathematics to exemplify what a hard or difficult thing is; it should be a shame to profit from the mankind's creations, in which Mathematics' contributions are essential; and keep promoting Mathematics as absurd, hard and unreachable.

Emergent category: the match of the mathematical scientific knowledge and the hidden knowledge of it

Interviewee 8, a Mathematician with 27 years of experience, professor, innovator and culture specialist, affirms that "it is unfortunate that the ignorance promoted by professionals of the rejection of Mathematics, that has affected the process of teaching, its diffusion and culturalization of each person. It is urgent to combine in the street, in the popular habitat, in the scientific communities in general what it is known of basic Mathematics and recognize it as an art, in the cultural heritage. The use of this [cultural heritage] to promote the literacy of the living Mathematics, identified with the people, and each human being. The popular knowledge hidden in Mathematics must be legitimated by scientists and recognized in the folklore. Political will is needed."

To understand about the meaning of the hidden knowledge, it is desirable to go to the rescue of that knowledge suppressed, that was disqualified, ignored by the scientific methodology, considered not finished, without probable scientific character like culture, daily life, like the historical, naïve knowledge, considered low-level, the hidden knowledge, imprisoned by a castrating philosophy of mathematics, the knowledge subdued are a "group of knowledge qualified as incompetent, or insufficiently elaborated, naïve knowledge, hierarchically inferior to the demanding level of scientific knowledge (..) from this popular knowledge, from this disqualified knowledge the critics have operated" (Foucault, 1986, p.5).

The mathematical clueless, cultural and popular knowledge, from the ethnic groups, is rescued in the studies of the Ethnomathematics, a research area that has important results that incite to another way to make Mathematics that addresses the daily life Mathematics in students. Ethnomathematics proposes an education that "stimulates the development of the inhibited creativity, driving new ways of intercultural and intracultural relationships (…) to make Mathematics a discipline that preserves diversity and erases discriminatory inequality (…). The Ethnomathematics Program has that major goal" (D'Ambrosio: 2006, p. 52).

Similarly, regarding mathematicians, it must be taken into account that, researching from the parcel of rigid disciplines, contradicts the social responsibility a teacher has as a citizen and as a human being, essentially. So, we must go, without any doubt, beyond disciplines, magnifying and making Mathematics transversal to the hidden knowledge, that kind of knowledge that doesn't go through the edge of science.

Emergent category: Insufficient academic training

Interviewee 9 says that "in first place, I can say that in our universities, the students who graduate from them are not well trained since they [the universities] lack of professionals in such area [Mathematics]. This is an important cause of the promotion of rejection of Mathematics in the teaching process.

In here, we have a very delicate topic: Why do we have teachers with so many problems when it comes to teach Mathematics? This is a very important question, a possible topic for another research. In general, that colonial education, imposed since 1492, with the invasion to our region, they out aside the education of Mathematics in this side of the world, and regarding the consequences of the invasion of this continent, it is known that "the first waves of European colonization in the XIV-XVIII centuries, brought new languages, religions and social order that ran over the indigenous cultures, the new global colonization imposes also new ways of living, of producing, of thinking" (Skovsmose y Valero, 2012, p.27). And the teaching of Mathematics didn't escape form that doing, thinking and power.

Regarding the Mathematics as a science, D'Ambrosio (1996) defines science, including Mathematics, as actors in this cultural invasion; and of course, the teaching of Mathematics is not an innocent spectator of these events. This science has been used to colonize and usurp our own knowledge of Mathematics that the very aboriginals have been constructing.

The teaching of Mathematics does not escape from colonization, first, and then from colonialism; that is why in the South, new movements emerge, researchers who recognizing their own Mathematical knowledge, appreciate ours, the struggle to unveil our contributions to Mathematics. The Mathematics as a legacy of mankind is not a parcel of the West, of nobody, actually; it is a right, it includes everyone. Currently, the teaching of the reductionist Mathematics, isolated from the dialogic processes in the students, persists; in addition to a growing rejection of science, and in Venezuela, despite of many advances, the wrong educative policies are kept.

3. RESULTS: INTERVIEWEES' ANALYSIS OF THE INITIAL QUESTION

In Pisa (2000) mathematical literacy is evaluated as a whole, in which the combination of the following factors is always given: *1) the skills to develop mathematical processes, 2) the mathematical contents, 3) the contexts in which Mathematics are used*. According to the opinions of the interviewees, regarding the initial question: What would be the cause for the elemental mathematical skills and concepts not being applied by professionals? On the contrary, even acknowledging the importance of Mathematics, they continue promoting its rejection. We

provided the outing line: *professional as a promoter of Mathematics as a science-legacy of mankind, as a civic responsibility of each one of us*.

Putting aside the false idea that Mathematics is a gift for a few, often called intelligent ones. Just as Rodríguez, Velásquez y Lemus (2019) claim, Mathematics are not a gift for "abnormal people", in fact, we do not believe in abnormalities to learn; everyone is different, their processes. What we do believe, however, is the such science is for the lovers of mystery, of the hidden, of the deep and critical analysis of what happens in Nature, of the problems; and such a passion can be awaken, many have been positively marked by their teachers, passionate teachers. Mathematics is poetry, is beauty. There is no product created by a human being and by Nature that is not have the blueprint of Mathematics. The Mathematics as a reachable knowledge is a challenge in the minds of those who believe in themselves, in the power of their mind, of their emotions. The fact that those who go into the world of Mathematics, never abandon their desire to know, to create, to understand, is an inaccessible mystery. The mathematics imbued in Nature, are outstanding creations of our beloved God.

For all of that, and more, Mathematics require the love and the recognizing of its legacy. It needs to be rescued. This rescue and protection must be under the responsibility of any professional who, knowing Mathematics is vital to practice any discipline in the transdisciplinary depth of the sciences, should be the promoter of Mathematics.

Outing line: *we all can minimize the false beliefs about Mathematics and its learning in educative communities; the democratization of Mathematics*. In Rodríguez, Velásquez y Lemus (2019) it is claimed that the aversion and false beliefs towards Mathematics must be attacked from primary levels in education, of course, this means making the students to lower Mathematics from its unreachable pedestal and connect it with their lives. And make everyone see that, no matter the definition of the word "abnormal", in general, the interviewees coincide that Mathematics is a gift to everyone who give loving and passionate dedication, motivated by innovating teachers who show a living Mathematics, with mind, body and heart in the lives of the students.

It worth mentioning that, in spite of the beliefs and rejection towards Mathematics, promoted most of the times by castrating teachers, it can be emphasized that Mathematics is not an elitist science reserved only for gifted people, or those with an obsessive dedication, or null social life. Mathematics is funny, this is, its study cheers up the spirit and can be understood as a healthy way of entertainment to interact with our loved ones and the development of a citizen educated for the times to come.

From the emergent category the rescue of the mathematical hidden and scientific knowledge, comes the outing line: *the culturization and the interculturization of Mathematics with*

the participation of all professionals and community. We must acknowledge that the legacy of Mathematics is in danger right now! It is necessary to wake up from the lethargy to see this science farther from the human being, understand Mathematics is vital in their life! This is a dilemma that must be resolved in order to make Mathematics achieve its main role as a science. It is relevant, from this perspective, the role in which Mathematics rises, destined towards the needs of men, this is, in his human, divine, intellectual, artistic part; the undeniably necessary science, that belongs to the daily life and satisfaction of anthropic classes.

Another outing line towards the mathematical literacy is: *the educative policies re-defined in favor of the promotion of Mathematics as a science-legacy of mankind*. We have to deliberate about the teaching of Mathematics as well as "the organization of education itself, of the school, of the school management, of the curriculum, of the place of the teacher and the students, among others. It deals with reconstruct an imaginary and an identity from another civilizing horizon" (Solano, 2015, p.123). That is why, in first place, the revelation and study of the human condition in the student, and to contribute of solutions to the false beliefs and attitudes towards Mathematics learning. It is urgent.

The education of the citizen, as the most important intellectual asset to manage, must be the goal of the current teaching of Mathematics; but not any education, but that that takes into account "the moral regeneration that needs the integration, in our own conscience and personality, of the principles of the autoethics, in order to reactivate our altruist and communitarian potentialities." (Morín, 2006, p. 194). It is about turn back to the continual education, towards humanization, that only the human being can construct, contributions that are supported by Rodríguez (2014).

To develop and practice a re-signified teaching of Mathematics, it is necessary the training of teaches who takes the teaching of Mathematics to the communities, children, the indigenous people, given the complexity of this education (interculturality, languages, indigenous territories); to achieve that, a complex, transdisciplinary and open curriculum is urgent. And with it, the reformulation of the curriculum of all careers.

Even thought the topic of the curriculum in not a topic to deepen in this research, it is important to say that according to González (2008) this already mentioned curricular design has elements of auto-organization, order-disorder and uncertainty, self-evaluation, complex strategy, teamwork, (transdisciplinary teams) and an education based in the complex research. So, this is how the teacher who does not interact with groups and learning communities, puts aside cultural elements, recreational activities or important ephemeris outdates. The patrimonial mathematical knowledge is legitimized by the teachers and the daily life experiences of the students.

4. BY THE WAY OF START AND CONCLUSION OF OPENINGS

In relation to the mathematical literacy in professionals as an urgent impossibility or re-signification, without doubts, it is necessary an imperative re-signification of what we conceive as mathematical literacy from the State's policies; which are promoters of a culturization and interculturization of Mathematics as a way to develop countries and the life of the human beings. But also, this is a task of the educative policies from all levels in the educative system. A titanic task in the communities, with a deep love in each cultural aspect and patrimony which are charged with the essence of Mathematics that must be explored and spread. Similar researches do not abound, the ones made with professionals, but the ones made with students proliferate, their literacy, etc. the classic references about mathematical literacy are essential in this study, i.e., the ones from PISA.

In the schools, according to Rodríguez (2019), it is urgent to recover a dynamic educative relationship, the self-esteem of the students, and with it, the self-esteem of the teacher as a professional, as an important manifestation in the course of their work in the teaching of Mathematics, and essential to their development; since this is involved in the configuration of their personalities, in the social relationships, in their own affectivity, in their cultural frames, in the motivation and their performance in science; hence, it is related with their life experience in its totality.

To recover the self-esteem, that has been lost in the classes of Mathematics, in the sense that they believe that they cannot learn it, it is pertinent the creativity, innovation and imagination in the educative praxis. Hence, the learning environments, the collaboration, the learning styles, all make sense in a renewed, innovative, and hopeful education.

The improving of the self-esteem, the beliefs, and the positive affectivities towards Mathematics in professionals can demystify the mentioned intellectual laziness that would lead to the transdisciplinarity in the training of professionals who not only perform in their disciplines, but also combine the importance of the knowledge and are bearers of main concepts of Mathematics that would help them in their careers, in the development of their lives. Mathematics is indispensable, and despite that, some interviewees recognize the laziness and lack of interest towards it.

All of hits is not other thing that a just demand that Mathematics as queen and indispensable help for all the sciences deserves and claims, in addition, it is necessary to rescue its legacy. This complex vision that also could be had about this science makes then that its transdisciplinariety, history and philosophy become part of the teacher and he could, through the true, reflexive dialogue and a negotiation of rules use in the classroom setting.

In this research, the mathematical literacy in professionals was researched as an urgent impossibility or re-signification, from the voices of different professionals. In this research, nine interviews were made to professionals of different careers, and the conclusions achieved, coincide with those of the theorical framework that has been developed. In this qualitative study, the author is bereaved of the problem, part of it, is victim of the modernist process of training, but she also is an agent of change who studies and promotes Mathematics as a body, mind and heart.

From the collaborators interviewed we could sketch out the following outing lines: *the professional as a promoter of Mathematics as a science-legacy of mankind, as a civil responsibility, minimization of the false beliefs about Mathematics in the learning communities, we all can; the democratization of Mathematics and the educative re-signified policies in favor of the promotion of this science-legacy of mankind.* This makes us think that the problem and then the need of mathematical literacy, is today, more than ever, responsibility of us all.

In these outing lines form the interviewees, we find spaces of need towards the mathematical literacy in professional as an urgent re-signification, the impossibility is minimized as soon as it is understood that Mathematics is essence and possibility in the development of the countries; the democratization of Mathematics and the educative policies must be in favor of such re-signification.

The transdisciplinariety in the training of professionals must be a weapon that ends the laziness, with the apathy, the false beliefs and demystify Mathematics from the lives of such professionals. But also, we extend the invitation to the professionals of different disciplines to research about the essential concepts of Mathematics, to use it as a tool in their work, and to diminish the laziness in science. All of this would reduce the collective rejection to Mathematics. To conclude, the mathematical literacy is a task to re-signify, and that it is not impossible, even more in professional.

The crisis in professionals who contribute to reject and not acknowledge the most elemental aspects of Mathematics, comes from an old culture that is related to false governmental and educative policies, where in the especial case of Venezuela, it lessens the study of Mathematics. All of this, in favor of an intellectual laziness. It is important to emphasize that the contributions of Mathematics in the development of a country and citizens educated in values, are a necessity. We must understand that without the diffusion of the legacy of Mathematics, it is not possible a deepening of knowledge.

ACKNOWLEDGMENT

Thanks to the group of professionals who, in an authentic way, from their daily job, accepted to be interviewed and answered towards a common end: the make of this research.

To the Magister Scientiarum in English, **Johnattan Chimaras**, Instituto Tecnológico, Santiago de Chile, for the full English translation of the article. Eternally grateful for the time spent lovingly on it.

BIBLIOGRAPHIC REFERENCES

Basarab, N. (1996). *La Transdisciplinariedad: Manifiesto*. Mónaco: Ediciones Du Rocher.

Cordero, Y. (2019). *Constructo teórico de los desafíos de las políticas educativas para Venezuela en el siglo XXI. Una mirada desde el paradigma de Modernidad Líquida*. Valencia: Universidad de Carabobo. Tesis de Doctorado.

D'Ambrosio, U. (1996). *Educacão matemática: Da teoria à pràtica*. Campinas: Papirus.

D'Ambrosio, U. (2006). *Ethnomathematics. Link between traditions and modernity*. Rotterdam: Sense Publishers.

Fehr, H. (2011). *Hacia la alfabetización matemática*. Cuadernos de Investigación y Formación en Educación Matemática, 6(7): pp. 57-70.

Foucault, M. (1986). "Por qué estudiar el poder: la cuestión del sujeto". En: AA.VV., Materiales de sociología crítica. Madrid: Ediciones La Piqueta.

González, J. (2008). *Reflexiones iniciales sobre la concepción del diseño y desarrollo curricular en un mundo contemporáneo y complejo*. Revista Integra Educativa, 1(2): pp.13-58.

González, M. (2018). Competencias básicas en educación matemática. Didáctica de la Matemática Didáctica de la Matemática. Universidad de Málaga. http://114.red-88-12-10.staticip.rima-tde.net/mochila/sec/monograficos_sec/ccbb_ceppriego/mates/aspgenerales/Competencias_basicas_en_Educacion_Matematica%20Gonzalez%20Mari.pdf

León, N. (2016). La formación del docente de Matemática en Venezuela: una acción en tiempo progresivo. Cuadernos de Investigación y Formación en Educación Matemática. 2016. Año 11. Número 15. pp 443-457. Costa Rica.

Morín, E. (1994). *Introducción al pensamiento complejo*. Barcelona: Gedisa.

Morín, E. (2006). *El método VI. Ética*. Madrid: Ediciones Cátedra.

OCDE (2013). PISA 2012 Assessment and Analytical Framework: Mathematics, Reading, Science, Problem Solving and Financial Literacy, Paris, OCDE. Recuperado de: http://dx.doi.org/10.1787/9789264190511-en

OCDE (2013). *PISA 2012 Results: Excellence through Equity: Giving Every Student the Chance to Succeed (Volume II)*. Paris: OCDE.

Palmas, S. (2018). La tecnología digital como herramienta para la democratización de ideas matemáticas poderosas. *Revista Colombiana de Educación*, (74), pp.109-132.

Revista Semana (2018). Los riesgos y costos de que cada vez seamos más analfabetos en matemáticas. Recuperado de: https://www.semana.com/educacion/articulo/por-que-somos-analfabetos-en-matematicas/576418

Rico, L. (2007). *La competencia matemática en PISA*. PNA, 1(2): pp.47-66.

Rodríguez, M, Velásquez, A, y Lemus, J. (2019). *¿Las matemáticas son para "anormales"? Vivencias y sentires de los actores del proceso educativo*. Visión Educativa IUNAES, 13(28): pp.73-79.

Rodríguez, M. (2010). *Matemática, cotidianidad y pedagogía integral: elementos epistemológicos en la relación ciencia-vida, en el clima cultural del presente*. Caracas: Universidad Experimental Politécnica de la Fuerza Armada Nacional. Tesis de Doctorado.

Rodríguez, M. (2014). *La gestión del conocimiento en las instituciones educativas en el clima cultural del presente*. Praxis Educativa ReDIE, 10: pp.7-27.

Rodríguez, M. (2018). *Narrativa de las matemáticas del amor y la amistad: Didáctica poéticas en la enseñanza*. Praxis Educativa ReDIE Revista Electrónica de la Red Durango de Investigadores Educativos, 19: pp. 40-55.

Rodríguez, M. (2019). *La relación educativa desde la pedagogía integral en la matemática: una innovación por re-significar*. Revista Magazine de las Ciencias, 4(4): pp. 12-25.

Santos, M. (2015). Uso coordinado de tecnologías digitales y competencias esenciales en la educación matemática del siglo XXI. En: La educación matemática en el siglo XXI, Xicoténcatl Martínez Ruiz / Patricia Camarena Gallardo Coordinadores, Colección PAIDEIA Siglo XXI: Zacatenco, pp.133-154.

Skovsmose, O. y Valero, P. (2012). Acceso democrático a ideas matemáticas poderosas. En Valero, P. y Ole Skovsmose, O. Educación Matemática crítica. Una visión sociopolítica del aprendizaje y la enseñanza de las matemáticas (pp. 25-64). Colombia: Universidad de los Andes, Centro de Investigación y Formación en Educación.

Solano, J. (2015). *Descolonizar la educación o el desafío de recorrer un camino diferente*. Revista Electrónica Educare, 19(1): pp.117-129.

Valero, P. (2017). *El deseo de acceso y equidad en la educación matemática*. Revista Colombiana de Educación, 73: pp.97-126.

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Agradecimientos / Acknowledgments:
Expreso mi agradecimiento a los docentes del Departamento de Matemáticas de la Universidad de Oriente, Venezuela.

Conflicto de intereses / Competing interests:
La autora declara que no incurre en conflictos de intereses.

Rol de los autores / Authors Roles:
No aplica.

Fuentes de financiamiento / Funding:
La autora declara que no recibió un fondo específico para esta investigación.

Aspectos éticos / legales; Ethics / legals:
La autora declara no haber incurrido en aspectos antiéticos, ni haber omitido aspectos legales en la realización de la investigación.