Error in the Technological Resources Used for Mathematics Education

Rafael Alberto Gonçalves
Regional University of Blumenau (FURB)

Stélio João Rodrigues
Education Through Faculties (EST)

In order to encourage the use of spreadsheets in everyday school life, more precisely in mathematics teaching, we have searched, over the course of more than a decade, for the applicability of these tools in the classroom. As we have applied fundamental properties of mathematics to the teaching and learning process, we have found, to our surprise, that bluntly, the spreadsheet makes errors in the process of solving certain activities. In our research to date, dozens of errors in applying the spreadsheet to solve activities have been recorded. So we may ask ourselves, why is this spreadsheet software still being marketed worldwide? In view of so many primary errors with catastrophic results already listed by these researchers, in different areas such as: health, economy, business, education, military among others, why don't the companies that own this software, charging abusive amounts in licenses to their users, make the necessary corrections in the computer programs?

Keywords: electronic spreadsheets, mathematical errors, properties

INTRODUCTION

Society is living, more than ever, under the auspices and domination of science and technology. This is so strong and striking that it is common for many to trust in them as one trusts in a divinity. The attempt to eliminate it involves, in the first place, a proposal that seeks to address the needs and shortcomings that society is facing due to rapid scientific and technological progress.

In this sense, the complex set of relationships and interactions required for teaching leads to a problem that only seems to be solved through effective interdisciplinarity between different knowledge fields. It is a significant challenge to break the excessive rigidity between the various professional communities that *adhere* to *their cultural* dictates, not giving shelter to a probable renovation embodied in the interweaving of the most different shades of knowledge.

Doing this successfully means to develop an understanding—both generally, interdisciplinary, and with specific examples; preserving the particular characteristics of each knowledge field—of what values exist, how people can sustain them, and how they evolve over time; to understand the genesis and function of social institutions in the political, economic and cultural spheres; to understand, in a general sense, the essence and inner workings of science and technology; to be familiar with scientific and technological reasoning, with the main current concepts and methodologies—to accept or reject them—with the design and configuration of strategies in the disciplines studied; and to have a holistic understanding of the complex

interactions between all these components. And if this is not enough, it is also important to know how art, literature, philosophy, history, and political, economic and sociological analysis, are reflected in this complex.

An approach that attempts to demystify the linear relationship of technological development with human evolution does not mean turning schools into temples to make their students into apprentice philosophers or sociologists. This attitude is neither necessary nor desirable. For this only interdisciplinarity is necessary, which can be achieved not through watertight disciplines, as the current solutions attempt to configure, but through groups of knowledge formed by the most diverse professors with the adoption of new and diverse techniques.

> Communication is the core of a good relationship and a good coexistence. Therefore, we communicate that a priori should be in our home, with our relatives. One of the best places to exercise the communicative processes is our home. The next place is the school environment, where teacher-student and student-student interactions are pleasantly established. (RODRIGUES, 2015, p.8)

Despite the enthusiasm for the effects of science and technology, the concern is more significant for the negative consequences of their uses, both in terms of the environment, the dominance of very powerful weapons of war, and the social issues arising from the dominant minority of all this knowledge. What is involved is the certainty that science can be a catalyst for development, achieving extraordinary funding, which implies the industrialization of science itself.

> If new information and communication technologies are seen as an essential resource for basic education, the same should apply to teacher training. However, initiatives to ensure that future teachers learn to use computers, radios, videotapes, tape recorders, calculators, the Internet and to operate educational software still need to be expanded. (BRASIL, 2010b, p. 530)

However, many continue with their unaltered positions, thinking and speaking as before, unable to understand the radically modified circumstances - *in the great majority not through ignorance, but by their own will, in order to enjoy certain privileges that this position provides* - in which they continue with their profession.

DEVELOPMENT

Why do some teachers and scientists not accept these changes and do not add to this reality other tools that have contributed so much to their work with their students and society? Will the dogmatic position of infallibility be the one that collapses? Do they want to continue as “magicians” in the quest to “transmit” knowledge that fatally leads to the greatest human comfort, regardless of whom they serve?

The existence of this new conception and this growing action against the problems generated by the understandable resentment that the scientific community was allowed an exacerbated flight autonomy, in which citizens had little or no influence, is leading to more open, more critical and more conscious debates.

This procedure could contribute to a scientific-technological development involved in the development of the whole society. As an important beginning in this cultural change, still strongly present in our civilization, we need, in a certain way, in technological education, in addition adopting a new epistemological approach, to consider other essential aspects.

Therefore, school education cannot be limited to “providing” students with knowledge and skills so that they can “get” a job in their adult life. It needs much more: it needs to make young people creative and critical of the achievements of science and technology that, in countless situations, they have contributed to creating; it needs to help them think respecting the aspirations of their peers and all citizens; it needs to make them careful with their health - *today very dependent on many technological results* - and, above all,

it needs to make them think, in a collective process, about the results and consequences of scientific-technological devices.

Education focuses on critical thinking about the richness of cultural values and life's moral and spiritual dimensions. It must be taken to all young people, with these premises, regardless of their knowledge, sex, creed, race or skin color. We have to understand education as a process involving knowledge; therefore, it is necessary to be familiar with it.

It is relevant to highlight the social approach to education and knowledge, i.e., education is a process of the social construction of knowledge, forming attitudes, and linking values and attitudes. Social development is a process that ensures national independence, guarantees sustained economic growth, preserves the environment, and ensures the democratic participation of the people as the main actor and beneficiary of this process.

Considering the educational context, we realize that the teaching and learning process must go hand in hand with social transformations. In this sense, educators also need to learn and teach with these new resources and methodologies. We emphasize the use of computers in the school environment, since this technology already covers many social routines.

Thus, we reiterate the importance of mathematical content for the use of spreadsheets, especially the function concept. Using spreadsheets, students can build and explore various mathematical concepts through their macro instructions, having the result in real-time. This process leads the student to think mathematically, experimenting, testing hypotheses, and creating strategies to solve the proposed problems. (BRASIL, 2006, p. 88)

In an information and communication society, the student must be included in this environment. Therefore, working with digital technologies in the school environment allows access to this world efficiently and effectively, since in this interaction the subjects develop new skills and competencies and participate in the teaching and learning process. (GONÇALVES, 2014)

> It is common for academics and even market practitioners to refer to systems as having intelligence, whether computerized (as is the case with some software) or not, when it comes to information technology. This is a common mistake, since computer systems are based on logic, i.e., mathematical calculations confer evidence based on probabilities that come from equations, algorithms and arithmetic expressions that, however complex they may seem, only simulate what is known as intelligence. (MEDEIROS e GONÇALVES, 2018, p. 51)

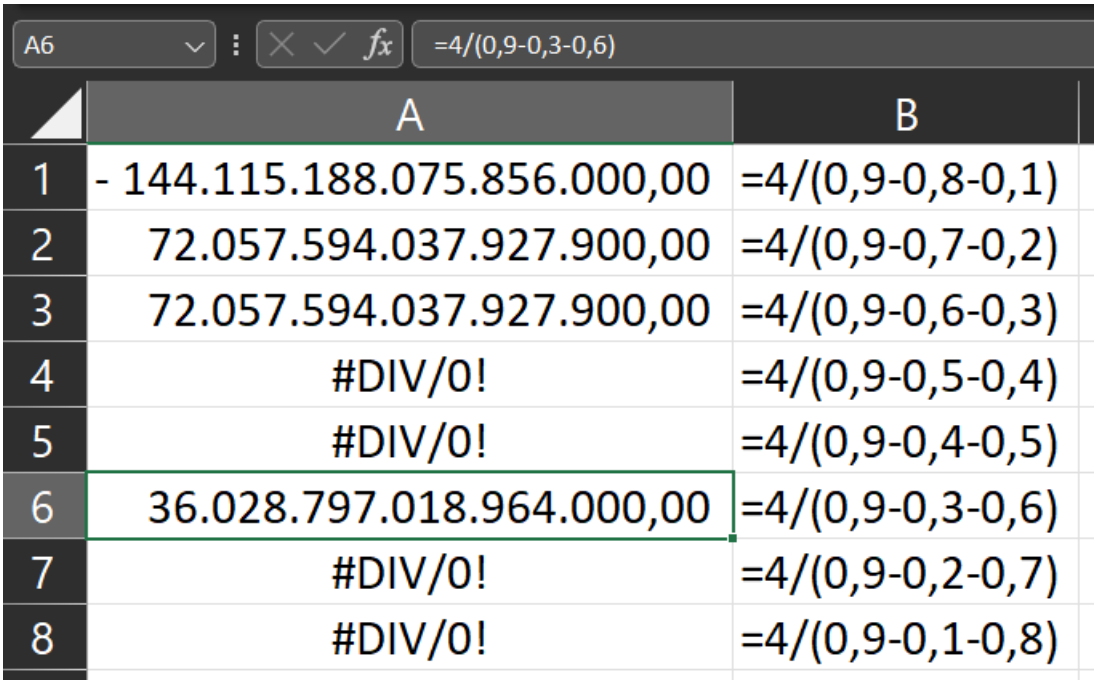
For this specific study, the authors focus this section of their studies on mathematical operations involving fractions with parentheses. To do so, it is initially necessary to remember that according to the solving properties, the adoption of parentheses as ordering elements of the priority sequence in the mathematical execution of any operation.

In arithmetic when we divide a number by zero, there is no result; in calculators and spreadsheets, the answer is ERROR. For example, when we divide 4 by zero (4/0), this operation has no value. If we do 7/ (3 - 2 - 1), by the properties we solve for the values in parentheses and then divide, which also results in 7/0, there being no value. If we do it using decimal values 6/ (0.9 - 0.8 - 0.1), the resolution rule is the same, first we solve the parenthesis and then the division, the result will not exist either.

However, when we apply the arithmetic resolution 4/ (0.9 - 0.8 - 0.1) to the spreadsheet, it can display results for which the arithmetic rules do not allow.

In the figure below we tried to change the values, in order to check if there was a pattern in the spreadsheet, however, what we noticed is that the spreadsheet itself gives contradictory results.

FIGURE 1
ARITHMETIC OPERATION



	A	B
1	- 144.115.188.075.856.000,00	=4/(0,9-0,8-0,1)
2	72.057.594.037.927.900,00	=4/(0,9-0,7-0,2)
3	72.057.594.037.927.900,00	=4/(0,9-0,6-0,3)
4	#DIV/0!	=4/(0,9-0,5-0,4)
5	#DIV/0!	=4/(0,9-0,4-0,5)
6	36.028.797.018.964.000,00	=4/(0,9-0,3-0,6)
7	#DIV/0!	=4/(0,9-0,2-0,7)
8	#DIV/0!	=4/(0,9-0,1-0,8)

Source: Developed by the authors

In rows 1, 2, 3 and 6 of the figure above, the spreadsheet provides a result that would be impossible by mathematical principles. However, in rows 4, 5, 7 and 8 the spreadsheet recognizes that it is impossible to obtain a result. So, we need to understand why there is a discrepancy in the results.

When applied in the classroom, we found an aversion, on the part of the students, to using Excel. And with a constant reflection:

– Abandon the Excel teacher.

With the spreadsheet as a great tool, companies prefer those proficient in this software. The authors ask whether it is feasible to insert spreadsheets in the classroom in the face of these basic and catastrophic inconsistencies. The more the authors investigate, the more errors they continue to find in applying the content.

CONCLUSIONS

Since ancient times, the constant quest for better living conditions has been at the center of human endeavors. These needs create possibilities for building a new world, with a better society and more fulfilled individuals.

Education is closely related to human progress and achievements, and this relationship is undoubtedly the result of its role as a transforming agent and simultaneously in continuous transformation.

The appearance of new challenges stimulates the search for other ways to solve them, thus provoking new mental constructions that Piaget calls *accommodation*. The relationships the child establishes with the object are based on the mental structures and knowledge of the world that he or she has developed.

Comprehension depends on the structuring and assimilation of actions regarding the object and the coordination of these actions. The manifestations of the environment are fundamental in cognitive constructions. The meaning of events and objects is produced by inserting them into a structure in the process of *assimilation*, which makes manipulating the elements involved essential.

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