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# Statistical literacy and meaningful learning: A dialogical counterpart

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**ABSTRACT**
In this chapter, we discuss the relevance of David Ausubel's model of meaningful learning for the development of statistical literacy. To this end, a rereading of the model of statistical literacy proposed by Iddo Gal is made from the dialogical perspective of language and culture that emerges from the work of Russian scholars commonly referred to as Bakhtin's Circle. The chapter is structured in three main parts, in addition to the introduction, conclusion and references. In the first, the general lines of the significant learning model are presented. In the second, the dialogical model of statistical literacy is discussed as a counterpart to the learning model described. In the third, the feasibility of such a counterpart is considered by examining BNCC guidelines. The main contribution of this discussion is the demonstration that learning theory, methodology and teaching practice and prescriptions of teaching work do not need to be separated, but can be articulated to enhance the effectiveness of formal education.

**Keywords:** Mathematics Education, Statistical literacy, Meaningful learning, Dialogism, Basic Education.

## 1 INTRODUCTION

Teaching long predates the relations of formal education such as those we experience today. In addition, the intellectual production on learning, although not as old as tradition, is also not recent. If, on the one hand, tradition and science have long informed teaching practice, on the other hand, professional practice seems to segregate what is discovered by it and inherited from it. Thus, learning in the context of formal education often occurs by the mere repetition of old procedures that do not necessarily enjoy scientific evidence or procedures that do not see in the intellectual production counterpart to the reality of teaching. In this scenario, the documents that guide formal education, such as curricula, tend to appear for teachers as prescriptions of a political nature, without guidance and pedagogical or academic foundations themselves.

The teaching of Mathematics is one of the processes challenged by such tensions and segregations, and the field of Mathematics Education has sought to intervene in order to produce knowledge that favors formal education. Not only from there, but also from there, a niche of interest arises in relation to social practices mediated by statistical knowledge: statistical literacy. In alignment with the contemporary understanding that *literacy* refers not to skills, but to social practices, which are not restricted to fine letters or the prestigious cultural canon, but encompass diverse social relations, (BROCKMEIER; OLSON, 2009) *statistical literacy* has been recognized as "the motivation and ability to access, understand, interpret, critically evaluate, and, if applicable, express opinions about statistical messages, data-related arguments, or issues involving uncertainty and risk." (GAL, 2021, p.41). We note that statistical literacy is not an object of teaching in Mathematics in Basic Education, but one of the objectives of its teaching. We study mathematics not to have intrinsic abilities, but to participate in numerous social relationships in which measures, graphs and proportions, for example, are crucial.

In this chapter, we demonstrate, albeit briefly, how the dialogical approach of statistical literacy is presented as a counterpart to the orientation of pedagogical practices based on the model of meaningful learning. By this approach, guiding documents of formal education, such as the National Common Curricular Base (hereafter, BNCC), configure clues on how to promote learning.

The text follows with a brief presentation of the model of meaningful learning proposed by David Ausubel. Next, we discuss the model of statistical literacy proposed by Iddo Gal in the light of the dialogical dynamics of culture that emerges from the body of work of the so-called Bakhtin Circle. Finally, we ponder how some BNCC discriminations can be interpreted by the articulation of the theory of significant learning and the teaching of Statistics in Basic Education in order to develop statistical literacy in students.

## 2 WHAT IS MEANT BY "MEANINGFUL LEARNING"?

It is very common in texts about the teaching and learning process to find the adjective "significant" referring to the type of learning that the teacher should develop in his students. However, this term is used inadvertently with its common, everyday meaning, denoting something important, relevant, useful and interesting. And, here for us, who doesn't want such an apprenticeship? It is obvious that every teacher wishes, through his teaching methodology, to promote such meaningful learning in his students. However, what few realize is that the term "meaningful learning" in the area of Education and Educational Psychology studies is much more than an expression of common sense; in fact, it is a technical term that references an entire psychological theory - of the same name - developed by the physician and psychologist David Ausubel.

For Ausubel (1963, 1968), the information in our mind – which he called the cognitive structure – is highly organized and hierarchically arranged in such a way that the more general information or knowledge forms large blocks of knowledge in which are located the more specific information related, in some way and at some level, to this general information. In current language, it is as if a broader theme functions as a large conceptual umbrella under which lie the sub-themes related to it. In Ausubel's language, these more general concepts existing or pre-existing in a person's cognitive structure are called subsumers and function as true ports or anchor points for the most specific information.

With this metaphor of cognitive structure – as a port where ships anchor in an organized and hierarchical way – Ausubel argues that the most important and facilitating variable of learning is what the learner already knows – his previous knowledge, that is, whether he has the appropriate ports with the appropriate anchors to support or dock the new knowledge ships – more specific information/knowledge – in an adequate and safe way. Thus, when anchoring is done appropriately, that is, when the new information to which one is having access finds a more general prior knowledge with which it can be anchored—a subsumer—Ausubel says that significant learning has occurred.

But what does Ausubel mean by "significant"? Moreira (2012, p.2) answers us clearly:

> Meaningful learning is one in which symbolically expressed ideas interact in a substantive and non-arbitrary way with what the learner already knows. Substantive means non-literal, not literally, and non-arbitrary means that the interaction is not with any previous idea, but rather with some specifically relevant knowledge already existing in the cognitive structure of the subject who learns. [...] It is important to reiterate that meaningful learning is characterized by the interaction between previous knowledge and new knowledge, and that this interaction is non-literal and non-arbitrary. In this process, new knowledge acquires meaning for the subject and previous knowledge acquires new meanings or greater cognitive stability.

Therefore, learning is significant for those who learn: the learner gives meaning to the new information with which he is having contact and this is both modified by what he already knows and modifies and expands his pre-existing cognitive structure in order to (trans)form a new subsumer – a new anchor capable of docking new ships of knowledge. For Ausubel, if learning does not take place in this way – meaningful and substantive – it will be nothing more than machine learning. If the information is not repeated or continued, it will get lost in the person's cognitive structure, without meaningful (and therefore arbitrary) connections, like a ship lost haphazardly on the high seas without guidance. In this way, the information thus processed will not be relevant and, consequently, discarded – forgotten.

In addition to previous knowledge, two other factors are pointed out by Ausubel as being the main influencers or promoters of meaningful learning:

- The didactic material used by the teacher needs to be potentially significant for the student, that is, "it is up to the teacher, therefore, in addition to identifying the students' previous knowledge, to develop didactic resources that relate to this previous knowledge in a non-arbitrary and non-literal way." (NOBREGA, 2023, p.33)
- The student/learner needs to be predisposed to learn. In other words, if the student is not interested in learning meaningfully, meaningful learning will not occur, "for learning meaningfully will involve effort and an active attitude of the student so that he can compare the new knowledge with his previous knowledge, analyze the differences and similarities

between them, and reflect on the meaning and significance of what he has learned again." (NOBREGA, 2023, p. 34). After all, "he who does not want does not learn." (SIMPLE; HAASE, 2020, p. 93).

## 3 A DIALOGICAL APPROACH TO STATISTICAL LITERACY

Fresh off a global Covid-19 pandemic, expressions such as "exponential growth", "mortality rate", "speed of contagion", "vaccine efficacy rate" among several were present in the most trivial conversations of everyday life. Similarly, in election years, especially state and national elections, "voting intention index," "percentage of ballots counted," "technical tie," "margin of error," etc. appear in news coverage of races and hence permeate various interactional instances. It is curious, however, that all these expressions of marked presence in the interactional dynamics seem distant from the didactic contents of Mathematics in Basic Education.

Active participation and interaction in these processes requires minimally technical training in these themes. For this, it is of fundamental importance that the teaching of Mathematics offered in Basic Education can provide the necessary theoretical elements. What is the conceptual basis for recognizing a "technical tie"? When, in the coverage of the counting of votes, is it possible to state that candidate $X$ has already been mathematically elected, even if there are still ballots to be counted? What is the difference between efficacy and efficiency of a vaccine? What does it mean that the death rate from Covid-19 is higher in the elderly than in the young? More than political opinions or passions, social debate develops rationally and responsibly if we master key statistical concepts. If the achievement of this interactional resourcefulness is one of the objectives of the formal teaching of Mathematics, we can say that statistical literacy is one of the desired results for formal education.

In Gal's (2002) model of statistical literacy, there are two axes: the elements of knowledge and the elements of disposition. Knowledge elements involve the statistical, mathematical, and context knowledge necessary for the development of statistical literacy in a given specific content. The elements of disposition refer to the beliefs, attitudes and critical posture of the subject in relation to the data and statistical information presented. However, based on dialogism as a principle of sociocultural relations, we categorize, at another time, (MAGALHÃES; NÓBREGA, 2023) the constitutive items of the literacy model in three axes. On the one hand, we grouped what, in Gal's (2002) model, concerned the theoretical-conceptual domain. On the other hand, we listed the items that described aspects of the subjects' experiential domain. We argue, however, that the effectiveness of literacy requires the dialogical dimension that unites these two other dimensions.

Table 1: Dialogical Model of Statistical Literacy

| **Theoretical Dimension** | **Dialogical Relations** | **Experiential Dimension** |
|---|---|---|
| • Statistical Knowledge<br>• Mathematical Knowledge | Beliefs, Attitudes<br>↔<br>Critical stance<br>↓ | • Literacy Skills<br>• Knowledge of Context |
| | Statistical Literacy | |

Source: Magalhães & Nóbrega (2023)

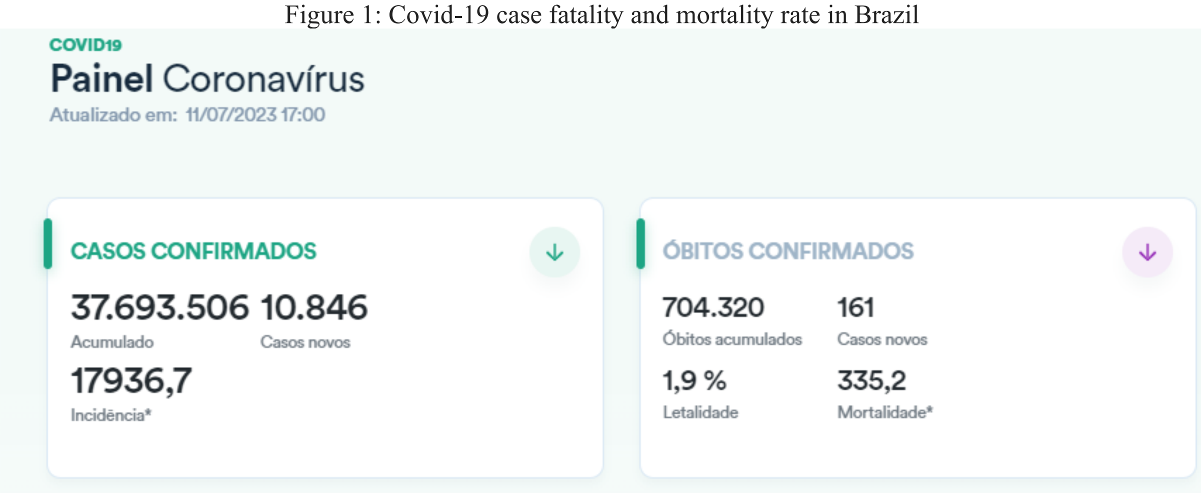
According to Bakhtin (2016, 2017), dialogical relations transcend logical relations, without denying them, and are personalistic in nature, in the sense that they imply the ethical responsibility of the subjects (BAKHTIN, 2010). In the model of statistical literacy in dialogical key, beliefs, attitudes and critical posture constitute the ethical signature of those who engage in an interactional process in which statistical knowledge is relevant. By this signature, conceptual knowledge, of a theoretical nature, is articulated with the skills developed in the experiential domain. From this articulation, the conditions  to access, understand, interpret, evaluate, express opinions on statistical messages and formulate arguments related to data or issues involving uncertainty and risk emerge.

Take, for example, the challenge of reading and interpreting information made available by the Ministry of Health regarding the Covid-19 situation in Brazil in 2023 (figure 1). Since the declaration by the World Health Organization of a global pandemic by SARS-CoV-2 in 2020, the theme of Covid-19 has taken hold in various fields of culture. The sanitary measures to contain the virus and remediate its effects on the population mobilized the legislative and executive institutions, the journalistic media reserved significant space for the dissemination of data, propaganda campaigns were broadcast, etc. The theme has permeated the most trivial conversations of everyday life that, although not governed by the same social coercions as the media,  Journalism, health units, feed on what these institutions circulate.

In this context, the understanding of measures, proportions, rates, indexes, among other mathematical and statistical conceptual constructs are fundamental for the exercise of citizenship. How to position oneself in relation to a decree of the State Government, for example, to contain the number of Covid-19 cases without being able to properly assess the data released? How to know if the numbers presented signal not only the effectiveness, but also the efficiency of vaccination? Was there a technical basis for scaling vaccine "brands" by efficacy? Without theoretical repertoire and technical skills to interpret the widely available data, the beliefs and attitudes implied in the critical stances taken by citizens with regard to knowledge about the coronavirus would not be able to be converted into meaningful learning. This is because crucial elements would be missing for the learner to discern indicative data from evidence from which subsumers could be constructed that would significantly organize the informational flow to which he was exposed. Without the foundations to identify evidence, beliefs and attitudes can reinforce cognitive dissonance, rather than fostering knowledge construction.

Let's see, for example, what previous knowledge is necessary to understand the information shown in Figure 1, which presents the Coronavirus Panel published on the Ministry of Health website, updated until 07/11/2023.

Figure 1: Covid-19 case fatality and mortality rate in Brazil




Source: Ministry of Health. Available at: <https://covid.saude.gov.br/>

Let's start with the lethality measure. The case fatality rate tells us the percentage of deaths among infected people and is calculated using a fairly simple formula:

$$Taxa\ de\ letalidade\ = \frac{número\ total\ de\ óbitos\ num\ determinado\ período}{número\ total\ de\ casos\ confirmados} \times 100 \qquad (1)$$

For the correct understanding and interpretation of the lethality rate are necessary, initially, the knowledge of division (ratio) and percentage, since rate refers to a percentage and this, in turn, refers to the product of a division by 100. The resulting value of this operation, the percentage, represents which part or fraction of the whole considered was affected by the object of interest, which, in the specific case, is the accumulated Covid-19 deaths recorded until 07/11/2023. According to the data presented, the total number of deaths from Covid-19 (cumulative deaths) in the period considered was 704,320, while the total number of confirmed cases in the same period was 37,693,506. Substituting these values into equation (1), we obtain the following lethality rate:

$$Taxa\ de\ letalidade\ = \frac{704.320}{37.693.506} \times 100\ =\ 1{,}868545\ \approx\ 1{,}9\%\qquad (2)$$

We noticed that the case fatality rate in the period considered was approximately 1.9%, which means that two out of every hundred people with Covid-19 evolve to death. If the one who accesses the site does not have these operational records in his cognitive structure will not form the necessary subsumers to relate to the definition of lethality rate, thus hindering its interpretation as well as its decision making in relation to the best attitudes in this scenario.

It is worth asking: what is the difference between lethality and mortality rates? Isn't lethality synonymous with mortality? Well, in the interpretation of epidemiological data, no. The mortality rate tells us the ratio of deaths among the entire population, and is calculated through the following expression:

$$Taxa\ de\ letalidade\ = \frac{número\ total\ de\ óbitos\ num\ determinado\ período}{número\ total\ de\ pessoas\ na\ população} \times 100T.000\qquad (3)$$

Note that, this time, the multiplicative factor of the ratio is 100,000, because the interest is to relate the number of deaths per 100,000 inhabitants. To arrive at this index, in addition to the knowledge of division (ratio), it is necessary to know the concepts of population and sample that will be objects of investigation in the study. Population refers to the complete collection of all the data to be considered – in this case, the estimated total number of inhabitants in Brazil as of 07/11/2023 – whereas sample is a subcollection or subset of selected members of a population – in this case, the total number of deaths. (TRIOLA, 2017). We should repair the asterisk next to the mortality data (figure 1). Apparently, the calculations of the Ministry of Health operate with the projection of a total of 210,119,332 inhabitants, a number estimated before the release, on June 28, 2023, of the official result of the last census made by the IBGE. Substituting these values into equation (3), we get:

$$Taxa\ de\ mortalidade\ = \frac{704.320}{210.119.332} \times 100.000\ = 335{,}2\qquad (4)$$

The result displayed in equation (4) is interpreted as follows: for every 100,000 inhabitants, and not just people infected with the coronavirus, approximately 335 have died from Covid-19 as of 7/11/2023. This shows the impact of the disease on the entire population.

Given this example, we note that it is not enough to have a critical stance for the good performance of citizenship, as well as it is not enough to have theoretical and technical knowledge. Therefore, the dialogical model of statistical literacy, in which dialogical relations articulate the theoretical and experiential dimensions, is shown as a counterpart to the model of meaningful learning. For formal education to achieve this endeavor, it is essential that Basic Education prescriptions and theoretical foundation about learning are articulated in teaching.

## 4 FOR A THEORETICAL-METHODOLOGICAL ARTICULATION BASED ON THE DOCUMENTARY PRESCRIPTIONS

The knowledge implied in the calculations previously performed, namely, reason, calculation of percentages, rates, population, sample, interpretation of data and statistical information, are included in the curriculum of Basic Education according to BNCC standards. Take, for example, the curricular guidelines of the area of Mathematics and its Technologies for the stage of High School. The proposal of BNCC for the teaching of Mathematics in High School is, in addition to consolidating, expanding and deepening the knowledge developed in Elementary School, to contribute so that students can

> develop skills related to the processes of investigation, model building and problem solving. To do so, they must mobilize their own way of reasoning, representing, communicating, arguing and, based on joint discussions and validations, learning concepts and developing increasingly sophisticated representations and procedures. (BRAZIL, 2018, p. 529)

For this, five specific competencies are proposed for the area of Mathematics and its Technologies and, related to each of them, skills to be developed are indicated. In table 2, we present the competencies and skills corresponding to the contents of Mathematics addressed in the previous section.

Table 2: Curricular guidelines for the teaching of Mathematics in High School

| **Competence** | **Skills** |
|---|---|
| Specific competence 1 (EC01):<br><br>Use strategies, concepts and mathematical procedures to interpret situations in various contexts, whether daily activities, or facts of the Natural and Human Sciences, socioeconomic or technological issues, disseminated by different means, in order to contribute to a general formation. | (EM13MAT101) Critically interpret economic, social situations and facts related to the Natural Sciences that involve the variation of quantities, by analyzing the graphs of the functions represented and the rates of variation, with or without the support of digital technologies.<br><br>(EM13MAT102) Analyze tables, graphs and samples of statistical research presented in reports published by different media, identifying, when appropriate, inadequacies that may induce misinterpretation, such as scales and inappropriate samples.<br><br>(EM13MAT104) Interpret rates and indices of a socioeconomic nature (human development index, inflation rates, among others), investigating the processes of calculating these numbers, to critically analyze reality and produce arguments.<br><br>(EM13MAT106) Identify everyday life situations in which it is necessary to make choices taking into account the probabilistic risks (use this or that contraceptive method, opt for one medical treatment over another, etc.). |
| Specific competence 2 (EC02):<br><br>Propose or participate in actions to investigate challenges of the contemporary world and make ethical and socially responsible decisions, based on the analysis of social problems, such as those focused on health situations, sustainability, the implications of technology in the world of work, among others, mobilizing and articulating concepts, procedures and languages of Mathematics. | (EM13MAT202) Plan and execute sample research on relevant issues, using data collected directly or from different sources, and communicate the results through a report containing graphs and interpretation of measures of central tendency and measures of dispersion (amplitude and standard deviation), using or not technological resources.<br><br>(EM13MAT203) Apply mathematical concepts in the planning, execution and analysis of actions involving the use of applications and the creation of spreadsheets (for the control of family budget, simulators of simple and compound interest calculations, among others), to make decisions. |
| Specific competence 3 (EC03):<br><br>Use strategies, concepts, definitions and mathematical procedures to interpret, build models and solve problems in various contexts, analyzing the plausibility of the results and the adequacy of the proposed solutions, in order to build consistent argumentation. | (EM13MAT313) Use, when necessary, scientific notation to express a measure, understanding the notions of significant numerals and dubious digits, and recognizing that every measure is inevitably accompanied by error.<br><br>(EM13MAT314) Solve and elaborate problems that involve quantities determined by the reason or the product of others (speed, demographic density, electrical energy, etc.). |

| | |
|---|---|
| Specific competence 4: (EC04)<br><br>Understand and use, with flexibility and precision, different mathematical representation registers (algebraic, geometric, statistical, computational, etc.), in the search for solution and communication of problem results. | (EM13MAT406) Construct and interpret frequency tables and graphs based on data obtained in surveys by statistical samples, including or not the use of software that interrelates statistics, geometry and algebra. |
| Specific competence 5 (EC05):<br><br>Investigate and establish conjectures about different concepts and mathematical properties, employing strategies and resources, such as observation of patterns, experiments and different technologies, identifying the need, or not, for an increasingly formal demonstration in the validation of these conjectures. | (EM13MAT508) Identify and associate geometric progressions (PG) with exponential functions of discrete domains, for property analysis, deduction of some formulas and problem solving.<br><br>(EM13MAT511) Recognize the existence of different types of sample spaces, discrete or not, and events, equiprobable or not, and investigate implications in the calculation of probabilities. |

Source: Brazil (2018)

Now, applying these curricular prescriptions to the dialogical model of statistical literacy, (MAGALHÃES; NÓBREGA, 2023) we obtain a configuration such as that presented in table 3.

Table 3: Dialogical model of statistical literacy

| **Theoretical Dimension** | **Dialogical Relations** | **Experiential Dimension** |
|---|---|---|
| ● Statistical knowledge<br>○ EM13MAT101<br>○ EM13MAT102<br>○ EM13MAT104<br>○ EM13MAT202<br>○ EM13MAT406<br><br>● Mathematical knowledge<br>○ EM13MAT203<br>○ EM13MAT313<br>○ EM13MAT508 | ● Beliefs and attitudes<br>○ EM13MAT102<br>○ EM13MAT202<br>○ EM13MAT314<br><br>● Critical stance<br>○ EM13MAT101<br>○ EM13MAT106<br>○ EM13MAT203 | ● Literacy skills<br>○ EM13MAT102<br>○ EM13MAT104<br>○ EM13MAT314<br>○ EM13MAT406<br>○ EM13MAT508<br>○ EM13MAT511<br><br>● Knowledge of context<br>○ EM13MAT106<br>○ EM13MAT202 |
| | Statistical literacy in dialogical key | |

Source: The authors

By way of application, we propose below a didactic sequence that develops meaningful learning so that students are competent consultants of the interactive panel of the Ministry of Health. What is desired is the promotion of statistical literacy for the responsible exercise of citizenship in decision-making processes regarding public health issues. For this, the application in a formal teaching context should: (i) pay attention to the documentary guidelines that describe the specific competencies and skills related to the didactic sequence, as highlighted in table 3; (ii) verify the prior knowledge necessary for the production of a potentially significant activity; (iii) select pertinent didactic material that addresses the teaching object and favors the student's motivation to learn; (iv) assess the extent to which the learning was non-literal and non-arbitrary.

Table 4: Orientation diagram for teaching the concept *of mortality rate and lethality* in the 3rd grade of high school

| **Guiding questions** | **Teaching Objects and Instructional Resources** | **Strategies** |
|---|---|---|
| (i) What competencies and skills are envisaged? | • See Tables 3 and 5 | • Consultation with BNCC<br>• Consultation of the local curriculum<br>• Consultation to the Pedagogical Project of the School |
| (ii) What prior knowledge is required? | • Ratio and proportion<br>• Percentage<br>• Indices and rates<br>• Variability<br>• Population and sample | • Proposition of problems<br>• Probing tests |
| (iii) What didactic material to select that is relevant in the extra-class context? | • Online text of scientific dissemination<br>• Interactive panel of the Ministry of Health | • Reading challenges: schematic reading, scanning, for example.<br>• Proposition of problems<br>• Probing tests |
| (iv) How to verify the non-literality and non-arbitrariness of learning? | • Different contexts and applications of *lethality and mortality rates* | • Proposition of problems<br>• Applications in other areas<br>• Use and discussion of other datasets<br>• Request that students come up with research problems or proposals |

Source: The authors

The diagram serves to organize the preparation of the didactic sequences, whose proposal can be formally transcribed as follows:

**Proposal:**
Meaningful Learning of Mathematics in the 3rd grade of High School

**Theme:**
Learning to calculate Covid-19 case fatality and mortality rates

**Goal:**
Differentiate case fatality rate and mortality rate

**Content to be worked on:**
- Ratio and proportion
- Percentage
- Indices and rates
- Variability
- Population and sample

**Required skills:**
- CE01
- EC02
- EC03
- EC05

**Skills to be developed:**
- EM13MAT102
- EM13MAT104
- EM13MAT202
- EM13MAT313
- EM13MAT511

**Material required:**
- Text of scientific dissemination made available online by the Government of the State of Minas Gerais: MACHADO *et al*. Covid-19 death rate: understand this concept! *In: Coronavirus - State Department of Health of Minas Gerais*. 2020. Available at: <https://coronavirus.saude.mg.gov.br/blog/81-taxa-de-mortalidade-da-covid-19>
- Interactive panel of the Ministry of Health. Available at: <https://covid.saude.gov.br/>

**Instructional resources:**
- Devices with internet access (mobile phones, computers or tablets)

**Estimated time:** 04 hours/class

**Methodology:**

**Step 1:**
- Gymkhana with tasks that mobilize the previous contents required. [Tasks developed in groups favor the exchange of knowledge and, when there is competition, favor the motivation of the learner]

**Step 2:**
- Consultation of the website of the State Department of Health of Minas Gerais to perform three consecutive tasks. [It is important that the next task is presented only when the previous one is completed]
  - What is the difference between mortality rate and lethality? [Scanning of the text to locate the concepts-object of teaching]
  - What is the algebraic expression of each? [Technical skill object of teaching]
  - How can we deduce population size from the mortality rate and the number of deaths? [Technical skill object of teaching]

**Step 3:**
- Consultation of the interactive panel of the Ministry of Health to perform the following tasks:
  - Redo the calculations using the estimate of the Brazilian population recently published by the IBGE. [Technical skill object of teaching]
  - Calculate lethality and mortality in your region and state. Compare the results. [Technical skill object of teaching]
  - Evaluate the rates found previously compared to national rates. What can be concluded? [Learning Check]

**Form of evaluation:**
- Troubleshooting

Table 5: Possible dialogical model for this didactic proposal

| **Theoretical Dimension** | **Dialogical Relations** | **Experiential Dimension** |
|---|---|---|
| ● Statistical knowledge<br>○ Population and sample<br>○ Variability<br>○ Rates and indices<br><br>● Mathematical knowledge<br>○ Ratio and proportion<br>○ Percentage | ● Beliefs and attitudes<br>○ Distinguish evidence and possible cognitive dissonances<br><br>● Critical stance<br>○ Identify the references mobilized<br>○ Check the sources and possible trends<br>○ Identify possible errors or problems in data collection | ● Literacy skills<br>○ Ability to interpret data, indices and rates<br>○ propose and evaluate the best decisions to be made in public health situations<br><br>● Knowledge of context<br>○ ways of contagion and spread of the virus<br>○ Consequences of the National Vaccination Plan<br>○ Public health policies |
| Statistical literacy in dialogical key | | |

Source: The authors

## 5 CONCLUSION

Nowadays, it would be an anachronism to think that the teaching of mere techniques without the proper relativization of didactic contents to the historical-social conditions in which the learners are inserted would lead to education that promotes citizenship. It seems a point of peace that the teaching object, although of a technical nature, needs to be contextualized in order to favor the construction of meaning on the part of the learner, allowing the new information substantially learned to find anchor points in its cognitive structure, modifying it and being modified by it as well.

In this chapter, we seek to briefly present a theory of learning that serves this desired purpose: Ausubel's theory of meaningful learning. In the case of the teaching of Mathematics described, the dialogical model of statistical literacy configures a counterpart for the implementation of pedagogical practices that, at the same time, stick to evidence, and not only reproduce traditions, and organize didactic contents guided by curricular prescriptions.

Of course, the suggested didactic proposal does not install a recipe, a procedural script. Differently, it serves to illustrate how didactic planning can architect different spheres: political, documental, pedagogical, etc. This architecture involves the organization of knowledge, elaboration or survey of pertinent didactic material and selection of appropriate strategies for each gesture of formal education with a view to promoting meaningful learning.

Based on what has been presented here, we dare to say that, from the teaching point of view, the dialogical model of statistical literacy configures an instrument for metacognition. By seeking to distribute competencies and skills required and intended for students articulating the theoretical and experiential world with specific dialogical relations, the teacher launches into a permanent informed improvement. This is the profile of the teacher-researcher in Basic Education: a teacher who does not segregate theory and practice, but integrates academic knowledge into professional practice. From the student's point of view, the dialogical model of statistical literacy can be used as a useful methodological guidance for the development of an effectively meaningful learning of topics that are so dear to Statistics and Mathematics as a whole. Therefore, it would not be a redundancy to add this aspect more in our proposed model (MAGALHÃES; NÓBREGA, 2023) and, henceforth, call it a dialogical-significant model of statistical literacy.

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