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Transcendence and learning to learn: transdisciplinary indicators aimed at Statistical Education

Transcendência e o aprender a aprender: indicadores transdisciplinares voltados a Educação Estatística

Alessandra de Abreu Corrêa[1]

João Bernardes da Rocha Filho[2]

Abstract

This article is an integral part of a doctoral study conducted on the articulations between transdisciplinary elements and teaching practices related to teaching statistics in the final years of elementary school. We sought to describe and analyze the possible approximations between Statistical Education and transdisciplinary studies, understanding their potentialities in the practices mobilized by teachers. Emerged analyzes from the teaching conceptions that were evidenced in the episodic interview, answered by two graduated participants in Mathematics from the city of Canela / RS. We apply the data analysis method called Discursive Textual Analysis (ATD), being a qualitative and comprehensive approach. The conclusions indicate that there are links between transdisciplinary indicators and teaching practices that permeate the professional dimension and achieve a transdisciplinary attitude that can occur through transcendence and learning to learn.

Keywords: Statistical education; Transdisciplinarity; Transdisciplinary Indicators.

Resumo

O presente artigo é parte integrante de um estudo de doutoramento realizado sobre as articulações existentes entre os elementos transdisciplinares e as práticas docentes relacionadas ao ensino de Estatística nos anos finais do ensino fundamental. Buscou-se descrever e analisar as possíveis aproximações entre a Educação Estatística e os estudos transdisciplinares, compreendendo suas potencialidades nas práticas mobilizadas pelos docentes. As análises emergiram das concepções docentes que foram evidenciadas, na entrevista episódica, respondida por duas participantes graduadas em Matemática da cidade de Canela/RS. A análise dos dados foi realizada com base na Análise Textual Discursiva, sendo uma abordagem qualitativa e compreensiva. As conclusões apontam que existem vínculos entre os indicadores de transdisciplinaridade e as práticas docentes que perpassam a dimensão profissional e alcançam uma atitude transdisciplinar que pode ocorrer por meio da transcendência e o aprender a aprender.

Palavras-chave: Educação Estatística; Transdisciplinaridade; Indicadores Transdisciplinares.

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[1] Doutora pela Pontifícia Universidade Católica do Rio Grande do Sul (PUCRS) Professora da rede pública do Rio Grande do Sul e da rede municipal de Gramado/RS, Brasil. Email: aleacorrea@yahoo.com.br

[2] Doutor em Engenharia, Metrologia e Instrumentação Professor Titular da Escola Politécnica - Curso de Física e PPGEDUCEM, Brasil. Email: jbrfilho@pucrs.br

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Introduction

There is no way to date the emergence of Statistics, because from the moment that man began the process of collecting and grouping objects and goods, the counting process began, and so descriptive statistics began, since it has as one of the objectives to systematize goods and people for the most varied purposes. It is possible to exemplify this situation with the census that were carried out in Babylon, around 4500 BC, in Egypt in 3000 BC and in China in 500 BC, in the population count and in ancient Rome, with the survey of properties.

Leti (2000) justifies that since the human mind is limited, the understanding of many phenomena requires only one observation, while others need numerous observations. These are collective or mass phenomena, like births, deaths and marriages in a certain period. However, in order to carry out this counting movement and thus quantify the collective phenomena, man "created" the statistics that gave support for the collective phenomena to be compressed in a quantitative way, thus the statistics has its origin as a practical activity related to daily life. Subsequently, state, demographic and social issues, which allowed for the improvement of the theory aimed at application in the social sciences, uses statistical techniques.

Statistics, Probability and Combinatory Analysis received space, according to Borba and others (2011), in the school curriculum, primarily in the United States elementary schools, in the document entitled *Agenda for Action*, edited by the *National Council of Teachers of Mathematics*, - NCTM - in 1980. Currently, he argues that basic education should cover skills aimed at:

> • Formulate questions that can be answered through data collection, organization and recording;
> • Select and use appropriate statistical methods for data analysis;
> • Develop and evaluate inferences and predictions based on data;
> • Understand and apply basic concepts of probability. (NCTM, 2011, p. 45)

The document also emphasizes that familiar and experimental situations could assist in the acquisition of such skills, since they encourage the transition from concrete to abstract thinking, both for statistical and probabilistic concepts.

For the final years of elementary education, the National Curricular Parameters (PCN) (MEC, 1998) presented that the statistical contents should have as objectives those of collecting and organizing data through tables and graphs, calculating the average, the mode and the median, with the objective of interpreting statistical data. In addition, they emphasized the importance of pedagogical work, making use of everyday cases presented in magazines and newspapers so that, in this way, data are treated and analyzed critically, using scientific methods and using real situations, to develop the capacity critical in relation to the data and their respective results, and only after making decisions (MEC, 2002).

At the National Common Curricular Base (BNCC) (MEC, 2017), one of the thematic units is Probability and Statistics, which has as main objective that

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> [...] all citizens need to develop skills to collect, organize, represent, interpret and analyze data in a variety of contexts, in order to make well-founded judgments and make appropriate decisions. This includes reasoning and using concepts, representations and statistical indexes to describe, explain and predict phenomena. (MEC 2017, p. 229)

Analyzing in a broad way, both the PCN (MEC, 1997 and 1998) and the BNCC (MEC, 2017) converge towards the same competencies to be explored. In other words, statistical knowledge is essential in school curricula, according to Lopes and Ferreira (2004), so that one can build a critical perception of daily life through understanding the probability, as this is important to process possible decision-making and make predictions. However, the presuppositions for the pedagogical practice to materialize are research and exploration, since both involve interdisciplinary characteristics that, for the authors, can encourage students to "[…] acquire less compartmentalized knowledge, through experiences that allow him to make observations and draw conclusions, thus developing his scientific thinking, fundamental to his education" (Lopes e Ferreira, 2004, p. 2).

All levels of educations include Statistical Education, as an area of knowledge, as well as being present in different contexts. The trends that characterize it cover a wide field, in all areas of knowledge. Teachers have difficulties in relation to statistical concepts and procedures, and need to overcome these difficulties. For that, it is necessary to have an understanding of the teaching objectives of Statistics. Holmes (1980) points out some reasons for this

> - Statistics is a part of general education, aimed at future adult citizens, who need to acquire the ability to read and interpret statistical tables and graphs that often appear in the media.
> - It is useful for adult life, as in many professions a basic knowledge of the subject is required.
> - Your study assists in personal development, promoting critical thinking, based on the assessment of objective evidence.
> - Helps to understand the remaining subjects of the curriculum where graphs, summaries or statistical concepts often appear, both in compulsory education and subsequently. (Holmes, 1980, p. 14)

Begg (1997), from another perspective, indicates that there are other reasons that highlight the importance of teaching Statistics, since it can be used in the processing of information and in the communication of data, encouraging the resolution of problems, the use of software computing, cooperative work and the introduction to school curricula. The author suggests that, through the concepts of Statistics and Probability, it is possible to introduce students to the application of mathematics to solve real problems, without the use of complicated mathematical techniques.

Following, Garfield and Gal (1999) state that for the formation of such competences, the individual needs to decode and understand the information that the data presents. This movement, in the authors' conception, is statistical thinking, where perceptions about data and uncertainty (concept of probability), make the individual able to propose inferences involving statistical and probabilistic concepts. In other words, the teaching of Statistics is

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fundamental to this process, considering that the development of statistical and probabilistic thinking will occur at the time when school curricula and teachers are in a position to perceive intersections between concepts.

For Martínez, Espinosa and Sánchez (2014), in primary school curricula, Statistics should be seen as a tool that allows students to carry out investigations that contribute to the development of skills in which learning to learn is fundamental the learning of statistical concepts together with work and experimentation.

So, based on this view, according to the authors "the statistics comply with their own definition of content the teaching and learning approach by competitions" (without page). It is noted that the importance of teaching Statistics is focused both on work, culture and on research (Batanero, 2001). Everyday life have innumerable information expressed in tables and statistical graphs. However, in order to understand and interpret this information, basic assimilation of statistical science concepts is necessary.

Batanero (2001) points out that the analysis and understanding of statistical information plays an important role:

> The relationship between a country's development and the degree to which its statistical system produces complete and reliable statistics is clear, because this information is necessary for making correct economic, social and political decisions. Statistical education, not only of the technicians who produce these statistics, but of the professionals and citizens who must interpret them and make decisions based on this information, as well as those who must collaborate in obtaining the required data, is, therefore, a development engine (Batanero, 2001, p. 3).

The author adds that Statistics was consolidated as "fundamental methodological science and the basis of the experimental scientific method" (p. 7) only in the 20th century, when it was realized that this science is related to many fields of interest to society.

Expanding the scope of this argument, some of the concerns registered by Batanero (2001) are related to mathematics classes, which should develop the reasoning and thinking present in random phenomena when they are expressed by statistical language. The following reflections are proposed by the author:

> - When considering the type of statistics we want to teach, and how to do this teaching, we must reflect on the main purposes and people of this teaching.
> - These students understand and appreciate the role of statistics in society, including its different fields of application and the way that statistics have contributed to its development.
> - These students understand and value the statistical method, that is, the type of questions that an intelligent use of statistics can answer the basic forms of statistical reasoning, its power and limitations. (Batanero, 2001, p. 118)

The same author also defends the importance of an emphasis on mathematical studies of random phenomena in basic education, since random situations are present in everyday life. First, it is necessary that "[...] the student evaluate the role of probability and statistics, it is important that the examples and applications that we show in the class make it appear as broad as possible" (Batanero, 2001, p 119).

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In this way, everyday situations can contribute for the student to perceive and apply the probabilistic and, consequently, statistical concepts, to real problems. Thus, different human situations was classified into groups of phenomena, such as man in the biological, social and physical world.

For example, in the biological field, the student may notice that we inherit different physical characteristics (sex, hair color, birth weight), others such as height and heart rate depend on the moment they were measured. In medicine, for example, the possibility of infection with a disease, the possibility of a diagnosis being correct and the possible effects of a vaccine are examples of situations that have a strong characteristic of randomness. Or even, when predictions are made about the global population or about the extinction of an animal species, probabilistic models are used, in the same way as estimates of the size of a disease or life expectancy of a being (Batanero, 2001).

About people in the physical world, we can elucidate the climate as an extensive source of examples of random phenomena, such as the location, intensity and duration of rains, storms or hail. The reasoning follows, from Batanero (2001), "so are the possible consequences of these phenomena: the volume of water in a swamp, the magnitude of damage from a flood or hail are examples in which the occasion for the study of statistics and probability appear" (p. 119).

In this category, one can still state, as an example, the measurements of any quantities, because regardless of the instruments used, there are inevitably random errors that can be analyzed by stochastics.

The dimension of a person in the social world depends on contemporary society. The family, school, work and any situation where social ties exist are sources of situations in which uncertainties will be present and, consequently, there is information (data) to be collected and analyzed about the profile of a given social environment.

The last dimension discussed is about man in the political world, is exemplified by government management. Any managerial level in the public sphere requires decision-making based on censuses and statistical surveys that indicate indices, for example, of goods production, demographics, trade, among others. That is, the studies of random variables that involve these contexts directly influence the governmental organization, and are linked and influencing other social dimensions (Batanero, 2001).

These dimensions help to contextualize and emphasize the importance of stochastic studies, for which data collection, organization, interpretation and analysis linked to real situations. Batanero (2001) emphasizes that, possibly in this way, teaching and later learning would find new meanings.

From another perspective, Cazorla and Utsumi (2010) emphasize that another objective of Statistical Education can be "[...] to study and understand how people teach and learn Statistics" (p. 9), and that aspects should be taken into account cognitive and affective

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aspects of teaching and learning, the epistemology of statistical concepts and the didactics of Statistics, so as to develop statistical literacy.

Researchers Campos, Wodewotzki and Jacobini (2001) show that there are also other objectives in Statistical Education, among them:

> • Promote the understanding and advancement of EE and its related matters;
> • Provide theoretical basis for research in teaching Statistics;
> • Improve the understanding of students' difficulties;
> • Establish parameters for a more efficient teaching of this discipline;
> • Assist the teacher's work in the construction of his classes;
> • Suggest differentiated evaluation methodologies, centered on established GOALS and SKILLS to be developed;
> • Valuing an investigative, reflective and critical attitude of the student, in a globalized society, marked by the accumulation of information and the need to make decisions in situations of uncertainty. (Campos, Wodewotzki and Jacobini ,2001, p. 12)

The objectives defended by the authors involve issues of a teaching and learning nature, with a convergence of ideas between the various authors mentioned, which confirms the importance of studying the field of Statistical Education.

Graham (1987) states another aspect when he write about that statistical projects motivate students, as questions arise such as "What is my problem? Do I need data? What? How can I get them? What does this result mean in practice? "(Batanero; Díaz, 2011, p. 21).

Holmes (1997) defend this methodology, who points out that teaching statistics through projects presents positive points, such:

> • Projects allow us to contextualize the statistics and make them more relevant. If the data arises from a problem, it is meaningful data and must be interpreted.
> • Projects reinforce interest, especially if the student chooses the topic. The student wants to solve the problem, it is not imposed by the teacher.
> • When the data is real, learning becomes significant and introduces ideas that do not appear with the 'data invented by the teacher': precision, variability, reliability, possibility of measurement, bias.
> • Shows that statistics cannot be reduced to mathematical content. (Holmes,1997, p.22)

In summary, working with projects, according to Batanero and Díaz (2004), reduces the risk of fragmentation of statistical and probabilistic concepts. We expected that students, among other skills, choose relevant topics for study, ask questions, collect essential data for the study, analyze and interpret the results according to the research objectives and, finally, submit reports, completing the studies related to the project. In contemporary times is recognized that all of this gains importance to the extent that the potential of Statistical Education, as well as the importance of developing transdisciplinary attitudes.

Otherwise, but following the same principle, Lopes (2012) emphasizes learning through problematizing activities linked to students' daily lives is one of the possible ways for

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mathematical and statistical concepts to follow paths where mathematical and statistical relationships are established with other disciplines.

The Brazilian researcher explains that "making this learning feasible requires a curriculum view for Mathematics that is different from linear" (p. 3). It is known that the mathematics curriculum is based on linearity, that linear thinking makes the contents sequentially linked to each other. However, prior to this statement it is necessary to understand that one of the functions of the discipline, according to Lopes (2012) is to be a modeler in society, which occurs, for example, when the curriculum promotes the mechanization of mathematical procedures. That is why

> […] it is necessary to think about some guidelines for Mathematical curricular proposals that favor a teaching action centered on assisting students in the development of mathematical reasoning and in the ability to solve problems, in the formulation and communication of mathematical ideas and in the establishment of relationships between different mathematical concepts and/or from other disciplines. (Lopes, 2012, p. 5)

It is noteworthy that, in order to achieve this process, the student needs to understand mathematical concepts and, subsequently, concepts of Statistics, which can occur with the use of themes that linked to the development of hypotheses, formulation of arguments, analysis and understanding of results. Mathematical concepts, appointed by Lopes (2012), can be used to build conditions for them to manipulate and experiment with materials, not only in a playful way, but in form that abstract thinking is developed.

Lopes (2012) also states we must preserve the stochastic character, as randomness helps to understand everyday situations and make decisions, at least when uncertainty is the source of questions. We need insert stochastic activities in other areas of mathematics, such as arithmetic, geometry or other sciences. Thus, Stochastics, in the Mathematics curriculum, is linked to interdisciplinarity, since this is a form of the development of probabilistic and statistical thinking, but it is necessary to strengthen the role of this science through research and instruction. This refers to both teacher training and studies of teaching and learning processes.

Research methodological procedures

This study has a qualitative nature and try to understand the similarities between the transdisciplinary assumptions and the pedagogical practices used in Statistical Education, based on the statements of two participants. One of them are a teacher retired from the public state school system from the city of Canela/RS, and the other teacher who work in the municipal school system from Gramado/RS and in the public state system in the city of Canela/RS.

These participants were chosen based on the following criteria: a) being a teacher of elementary school, final years; b) have a degree in Mathematics, Physics or Sciences, and c) teach Statistics. In addition, the availability for the interview was also one of the criteria considered.

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The teachers involved in the research have long experience in teaching classes in the subject (s) of Mathematics and/or Physics. This time of teaching activity was able to contribute for the teachers to lead the situations of the school daily life more easily, as well as it was a factor that allowed a greater application and focus on understanding the teaching process of Statistics. Thus, it was possible to draw a profile that characterized the teachers who work in the teaching of Statistics, in the context of the research, verifying the transdisciplinarity in their manifest attitudes.

Based on the data collection strategy highlighted above, the Discursive Text Analysis (ATD) was adopted as an analytical strategy, inspired by the methodological contribution of Moraes and Galiazzi (2007), which is based on phenomenology and hermeneutics, because "[...] it focuses its search on collective networks of meanings constructed subjectively, which the researcher challenges to understand, describe and interpret " (p. 168).

The ATD enables the construction of new paths, which are initially perceptions, but that through understanding, induction, criticism, description, interpretation, writing, among other elements, allows the acquisition of the knowledge that allows (re)building new perspectives. Below, were described some empirical recurrences about the articulations of work and transdisciplinary elements found in the professional practices of mathematics teachers of elementary school in the final years, when teaching Statistics.

"Transcendence" and "learning to learn" focused on Statistical Education

After these insertions in the field of Statistical Education, we seek to establish relationships with transdisciplinarity through the indicators listed by Machado (2016), whose theoretical basis is the studies of Nicolescu (2005). In addition, we believed that a transdisciplinary view does not depend on the field of study and for that, these indicators are acceptable tools.

Regarding the theme, Machado (2016) wrote his doctoral thesis on the indicators of transdisciplinary attitudes that he listed eleven transdisciplinary indicators. The author concluded "there is a strong relationship between the occurrence of transdisciplinarity indicators and the satisfaction of being a teacher and living in our society" (without page). In addition, he noted that transdisciplinary attitudes lead to personal satisfaction in relation to teaching, which provides subjective benefits to the teacher and makes educational actions more effective.

For the moment, we addressed two transdisciplinary indicators: "transcendence" and "learning to learn" (Machado, 2016) and the possible relationships that exist with Statistical Education. The speeches of the participants present traces of these indicators in their teaching practices, in the teaching of Statistics.

Initially dealing with transcendence, a word of Latin origin, "transcend", according to the Priberam dictionary of the Portuguese language, means: 1) to exceed; overcome. 2) be greater than. 3) being transcendent; go beyond the ordinary; rise above the ordinary. This

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term is expressive in the field of religious cultures and traditions, as it involves the ability that human beings have to develop their own behavior based on their conceptions and beliefs, in the expectation of becoming better or achieving a better situation in relation to current. D'Ambrosio (1997, p. 165-166) argues that this is a "essential principle, called, in the different traditions of spirit, soul, karma and various other denominations. The will generates the essential need to explain, understand, transcend one's own existence, extract it from his ancestors, project them into future generations.

Contrary to what is commonly believed, the central element of all religions is not the belief in a deity, as there are religions without gods, with one god or with many gods, but the belief in transcendence (Flores; Rocha Filho; Samuel, 2014). In addition, Shock (2012) brings other meanings of the word "transcend". Among them, it can be understood as "the ability to overcome, to go beyond the ordinary, beyond the frontiers of knowledge" (p. 207), or even as "the ability to break barriers, to overcome and violate prohibited, to go beyond all limits " (p. 207). With these words, the researcher suggests that we are beings with a basic characteristic: we are transcendent.

As we are aware of who we are - self-awareness - we ask questions that can lead us to transcend, to seek answers further and further. Through transcendental experiences, it is possible to overcome the limits that the everyday presents us (Shock, 2012). In the participant's speech,

> [...] she asked, asked, questioned and little by little we were thinking in other different ways, reaching conclusions. (Participant P1)

When asked about her learning in Statistics, the participant emphasizes that her teacher encouraged them to think through questions that helped them to think in other ways. In other words, this is a principle of transcendence: exceeding limits. The vision that the participant's teacher had was to go further, with an intentional and reflective look. The participant adopts this teaching mode for her students. "I go on questioning, 'inventing' to encourage them to think and feel valued for the work done" (Participant P1), similar to the way they learned.

This fact suggests that the participant uses intentionality, making the transcendent become an act of investigation of the world and, thus, making possible the emergence of the real and the unreal and, consequently, making the students' potential emerge. Intentional pedagogical practices are those that make it possible to expand the look, the knowledge, the doing and the thinking. These assumptions are necessary for teachers to improve their actions and pedagogical practices (Santo, 2003).

> I always teach mathematics (I love it / laughs) and, more towards the end of my career, 'didn't give up' the ninth grade because I was able to carry out different activities and invent a little. (Participant P1)

For Moraes (2014), transdisciplinary knowledge goes beyond disciplinary boundaries when the look is focused on overcoming the level of primordial reality, to a level of comprehensive reality. This improvement occurs when reality is transcended and the "respect

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for the other's thought, which although different from mine, is absolutely legitimate" (p. 60), is recovered.

In this way, it is possible to understand how previous knowledge influences the perception of the other and, thus, according to Moraes, to search for new ways of "being / knowing, of living / coexisting and learning" (p. 60). Incentive for education, based on human multidimensionality, which is a characteristic of transdisciplinarity, as it considers emotional and affective aspects essential to the process of structuring knowledge. The speech of participant P2 points to the overcoming of the level of common classroom reality, which was 'awakened' in her initial training. Griffins were made to highlight this fact.

> In me, I don't know what happened (laughs), after this class I started to 'mistrust' the information. I heard or saw it on TV and thought: But is that it? But how did they collect this data? What is this research for? I thought: 'I'm going to go crazy' (laughs). I started to like and teach Statistics in other ways, with a look turned to reality, looking for connections with the students' context, listening to the ideas that emerged from the results. (Participant P2)

It is also possible to notice that there is a concern to know, live and learn with the students' reality, that is, traces of a multidimensional process where reality, the emotional and the imagination are observed as being important factors in the construction of knowledge. This can transgress the subject/object relationship and transcending the isolation of disciplines towards the multiplicity of knowledge (Moraes, 2007).

In this other fragment of speech, participant P2, presents a critical attitude towards the situation experienced, showing the profile of a "researcher, interdisciplinary and/or transdisciplinary subject in his attitudes, thoughts and practices" (Moraes, 2007, p. 19).

> [...] people thought it was more important to know the basics. In addition, Statistics was not in the basics. Only when I took a course in Statistics at college did I notice what I had failed to teach to students and, at the same time, what I could teach to students to come, do you understand me?! (Participant P2)

The speech also brings the perception of the moment of change in their teaching practice in favor of the teaching and learning of their students and, consequently, their personal learning. For Moraes (2014), assisting the development of skills and competences encourages the student to

> [...] recognize yourself as a person, discover your talents and skills, your creativity, your sensitivity and your structural flexibility in relation to knowledge; perceive its capacity to anticipate and adapt to emerging situations that characterize our changing reality. (Moraes, 2014, p. 19)

This teaching attitude develops the ability to explore new methodologies based on the principles of complexity, interdisciplinarity and transdisciplinarity, as teaching and learning are carried out together with students, through constructive, reflective, creative and ethical thinking.

In this way, it is possible to transpose the present level of reality, to a more comprehensive one. Being aware of themselves and their attitudes makes the teacher

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> [...] perceive life and the mind as constituent elements of a single and very complex process, while recognizing the existence of this systemic and complex paradigmatic structure that is behind the events, phenomena and processes, in constant becoming. (Moraes, 2007, p. 28)

Therefore, in the words of Portilho and Crema (2017), transdisciplinary knowledge is related to transversal conduct, because "the transmutation of information, of instruction into conscious knowledge, [is] united to the spirit and at work in man-man, man-world relations, man-nature" (p 29). Consequently, transdisciplinarity transcends time and space, which is also an interdisciplinary movement.

One of the ways to carry out this movement is through "learning to learn" (Machado, 2016), another transdisciplinary indicator that articulates with teaching practices in the teaching of Statistics. For the researcher, learning occurs when there is an open human relationship with the other, where flexibility between disciplines, theories and practices is present.

Portilho and Crema (2017, p. 29) attribute meaning to the act of learning as the "act of responsibility and reciprocity, as it involves a commitment to Life, to the quotidian, to the other", and this definition is the basis reflections of this study.

In the speech of participant P1, the concern to learn, to teach is noted, and with that the participant recognizes herself and the involvement with the other becomes visible.

> I recently finished my Specialization in Education. I wanted to do it in the area of Mathematics, but I couldn't find a course that was in line with my possibilities. Even so I did it because I always liked and I like to study, to learn and to teach and to learn. And no matter what it is to learn as a teacher said 'it never hurts'. (Participant P1)

Learning becomes self-knowledge when you reflect on the knowledge that is meaningful to you. Learning is a constant recognition. Recognize your potential and your weaknesses. When there is this recognition, for Portilho e Crema (2017), it is possible to be receptive to teaching and learning, leaving the limited space of living and Being to "look that sees between, beyond and through the disciplines" (p.29), that is, fragmentation must overcome the limit of the disciplines and search for more complex units, which are carried out in social relationships and interactions.

Education is one of the possible ways for this to happen. Understanding the meaning of actions is one of the conditions for knowledge. Portilho and Crema (2017) name this process as interrelational, as it is a process of self-knowledge, reflection and transformation, and when it is directed towards values such as the recognition of the other, of nature and of the Cosmos, it forms the integral Being. Interrelational relationships make these values first form in the individual, and then spread in the social context. Any and all values must be "recognized, apprehended and validated by the collective whole, but first they must go through the same process within the individual" (Portilho e Crema, 2017, p. 34).

According to participant P2, "as in this case, open to the community, because, for nothing, but it was very good! Flawless calculations, graphs, and tables (laughs). That year

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we got a star from the director (laughs) because we also contributed to the construction of the city's history". It is observed that there is a process of involvement with the community and a satisfaction in being part of the history of the city, in addition to contextualizing and inserting the student in the context of the real, which for Barbosa (2005) is the basis of learning transdisciplinary. For this, "one must take as a starting point, no longer theory, but reality itself. The construction of knowledge must start from things and problems, as the human being is made of what he does" (p. 372). The act of learning is linked to what is known and how it is known, which involves different levels of reality and predicted and unforeseen situations, as well as imagined and unimaginable.

This justifies the need to sustain flexibility between disciplinary rigor, theories and practices, as well as interpersonal relationships. In the speech of participant P2 "We traced the common objective and each one within his knowledge, we made statements about how he could achieve the objective, but one helping the other" are traces of what was highlighted previously, because the convergence of various aspects of the knowledge around an object is one of the principles of transdisciplinarity (Barbosa, 2005).

Final statements

Under the transdisciplinary view, indicators such as "transcendence" and "learning to learn" (Machado, 2016) can also be articulated with Statistical Education and teaching practices to achieve this goal. The transcendence allow the possibility of going beyond what is given and done, making it possible to add and create dreams, utopias, projections for the future. With the human being, in one way or another, looking for this transcendence, as is deduced from the religious spirit disseminated in all cultures, pointed out by Flores, Rocha Filho and Samuel (2014), "learning to learn" occurs when the teaching is associated with the conditions listed above. As transcendence is a natural inclination of the human, it favors openness to understand the connections between disciplines, theories and practices, allowing the overcoming of the vertical, specialist and disciplinary view in favor of a transcendental view in any activity.

As Statistics considered a source of knowledge and, consequently, of education aimed at the formation of citizens, Batanero (2002) argues that the main function of the teaching of Statistics is the formation of statistical culture. The statement of Wallman (1993), here adopted as the ability to understand, evaluate and critically appreciate the statistical results that permeate our daily lives for making public and professional, as well as private and personal decisions. In addition, Batanero (2002) shows that there are professional statisticians for solving problems that require specific knowledge, as well as computer programs that perform calculations and graphical representations.

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