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Genetic Determinism on Teachers' Perceptions about Etiology of Mental Disorders

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Genetic Determinism on Teachers’ Perceptions about Etiology of Mental Disorders

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Abstract

Mental disorders are disorders of the cognitive, emotional or behavioral condition of an individual. They can have several origins and are usually associated with expressive anguish and difficulty in various aspects of life, including school education. Mental disorders are accompanied by social stigmas which may be linked to the belief in genetic determinism, i.e., in the perception that mental disorders are unchanging. The objective of the present study was to understand the perception of Brazilian teachers of all levels about the etiology of mental disorders. The results showed that most of the teachers studied believe in the predominance or exclusivity of genes in mental disorders, and do not consider the environment as a potential influencer of their occurrence or mitigation. This perception approaches the belief in genetic determinism and can justify the labeling of students with mental disorders and the consequent perpetuation of social stigmas. It is therefore recommended to promote knowledge in this area, including knowledge of the dynamics of interaction between genes and the environment, helping educators to prepare and to be able to act according to the reality of each student without creating inappropriate stereotypes.

Keywords: Mental health; Genetic determinism; Stigma; Educational environment; Inclusion.

Determinismo Genético en las Percepciones de los Profesores sobre la Etiología de los Trastornos Mentales

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Resumen

Los trastornos mentales son trastornos de la condición cognitiva, emocional o conductual de un individuo. Pueden tener varios orígenes y generalmente se asocian con angustia y dificultad expresivas em varios aspectos de la vida, incluida la educación escolar. Los trastornos mentales van acompañados de estigmas sociales que pueden estar relacionados con la creencia en el determinismo genético, es decir, en la percepción de que los trastornos mentales no cambian. El objetivo del presente estudio fue comprender la percepción de los docentes brasileños de todos los niveles sobre la etiología de los trastornos mentales. Los resultados mostraron que la mayoría de los docentes estudiados creen en el predominio o exclusividad de los genes em los trastornos mentales, y no consideran el medio ambiente como um posible factor de influencia en su aparición o mitigación. Esta percepción se acerca a la creencia en el determinismo genético y puede justificar el etiquetado de los estudiantes con trastornos mentales y la consiguiente perpetuación de los estigmas sociales. Por lo tanto, se recomienda promover el conocimiento en este área, incluido el conocimiento de la dinámica de interacción entre los genes y el medio ambiente, ayudando a los educadores a prepararse y poder actuar de acuerdo con la realidad de cada estudiante sin crear estereotipos inapropiados.

Palabras clave: Agresión entre iguales, acoso sexual, escuela, adolescencia, Finlandia, Turquía

Mental disorders are clinically significant disorders in the cognitive, emotional or behavioral condition of an individual, characterized by perceived dysfunctions in psychological, biological or developmental processes underlying mental functioning ([American Psychiatric Association, 2013](#)). They are usually associated with expressive distress or disability in social, occupational, or other important life activities such as educational process ([American Psychiatric Association, 2013](#); [Lopes et al., 2016](#)). The mental disorders may be understood as conditions multidimensional and categorized from distinct diagnoses, or may be understood as an unidimensional and general condition from statistics scores and comparative genetics analyses ([Caspi & Moffitt, 2018](#); [Selzam et al., 2018](#)). In the last case, the general dimension for mental disorder is called “p factor” - named as a reference to g factor for intelligence or g of Spearman ([Spearman, 1904](#)) - The factor p is a score which covers all the disorders, each disorder is loaded with a value of p factor. The greater the p factor of individual or group, greater the probability of commitment by some disorder ([Caspi & Moffitt, 2018](#)).

There are several ways to understand mental disorders, both regarding their nature and their treatment and cure. It is important to differentiate mental disorders that are genetically influenced and syndromes caused by genetic conditions and that have mental disorders as symptoms, such as Down’s syndrome and Fragile X syndrome ([Asbury & Plomin, 2013](#)). This wide definition means that there are several ways to understand mental disorders, both regarding their nature and their treatment and cure. It is important to differentiate mental disorders that are genetically influenced and syndromes caused by genetic conditions and that have mental disorders as symptoms, such as Down’s syndrome and Fragile X syndrome ([Asbury & Plomin, 2013](#)). Knowing the etiology of mental disorders may help to prevent or mitigate the expression/symptoms ([Uher & Zwickler, 2017](#)), to deal with in a personalized way considering the student profile ([Asbury & Plomin, 2013](#)), and also to minimize or extinguish deterministic beliefs ([Gericke et al., 2017](#)) and social stigmas that are negatively associated with it ([Centre for Addiction and Mental Health, 2001](#); [Ke et al., 2014](#)).

Among the 10 largest replicate findings, i.e. supported by more than one group of researchers on behavioral genetics, listed by [Plomin et al \(2016\)](#), the first two put an end to the nature x nurture dichotomy: “1. All psychological

traits show significant and substantial genetic influence, and 2. No traits are 100% heritable genetic influence” (Plomin et al., 2016, p. 4 and 5). There is no single responsible factor - genes or environment - for the expression of behaviors in general. These factors are so deeply entangled that it is often difficult to know what is due to genetics and what is due to the environment (Briley et al., 2018). And it is even more complex for many mental disorders, that leads to behavioral not socially accepted, the symptoms are defined synthetically or artificially, based in part on what is or is not "normal" in socio-cultural groups (Plomin et al., 2011; American Psychiatric Association, 2013, p.14).

Studies comparing data from monozygotic and dizygotic twins, as well as studies on adoptive families, have raised the perspective that the environment, allied with genes, matters and contributes in several ways (Plomin et al., 2016; Uher& Zwicker 2017). Some studies simply give more or less importance to one or the other factor. It is necessary, however, to consider that the “environment” involves more than a single source of influence: (1) there is a division between shared environment, the one the individuals have in common and the non-shared environment, represented by idiosyncratic events of life; (2) it is not possible to isolate the various aspects of the environment, shared or non-shared, because there will always be a broad occurrence of simultaneous events that cannot be measured separately. The environmental factors that can influence a disorder are very diverse, ranging from poverty and malnutrition to stress and urban environments (Uher& Zwicker, 2017; Plomin et al., 2011) and it is still necessary to take into account the environments that influence organisms at the epigenetic level (Nestler et al., 2016). In this respect, it seems to be easier to measure the role of genes than the role of the environment (Plomin et al., 2011).

The etiology of mental disorders, therefore, is the complex result of multiple factors based on the genetic-environment, environment-environment and genetic-epigenetic interactions involved. However, do Brazilian educators have this theoretical knowledge and, even if they have it, can they apply it or extend it to their class? Knowing how to make the transposition from a theoretical approach to educational practice would enable teachers to rid students of an immutable condition based on the belief in genetic determinism, which creates stigmas and a self-image that will accompany the student to adulthood.

Mental Disorders and the Educational Environment: Relationships, Perceptions and Stigmas

Common mental disorders, which are associated mainly with symptoms of depression and anxiety, occur at a 30% rate among Brazilian students, a rate similar to the worldwide figure (Lopes et al., 2016). It is now widely accepted that students with mental disorders require differentiated educational support and care that will be effective in restoring their mental health not only in specialized institutions but also in the general educational system (Asbury & Plomin, 2013). There is evidence that teachers' perceptions about their students influence this process (Soares & Bejarano, 2009; Castera & Clément, 2014; Antonelli-Ponti et al., 2018). Beliefs in gene exclusivity can foster prejudiced and stigmatizing attitudes, but it can also be a way of justifying the behaviors expressed by people with mental disorders and generating tolerance towards individual differences (Heine, Dar-Nimrod, Cheung & Proulx, 2017). However, in both cases, it's possible the decrease of day-a-day investment in the students education.

The remarkable change in mental health patterns of children and adolescents in recent decades puts on our hands the possibility to enhance future human quality of life (Lopes et al., 2016). The progressive and constant increase in the prevalence of mental disorders had already been detected in the mid-1980s through the quantification of hospitalizations in psychiatric hospitals in Brazil (Morgado & Coutinho, 1985). But the increase in incidence could be just a reflection of the increase in the country population, which would increase rates of unemployment, poverty, and violence, generating insecurity and anxiety, according to the authors. Werlen et al. (2020) argue that one should invest in identifying young people in need of care from the general population and then involve them in the health system. In any case, it is noted that the in-depth knowledge of educators regarding diseases and mental disorders did not follow the increase in demand. Consequently, there is a deficiency in the promotion of pedagogical strategies geared to each condition, with other effects on students learning abilities (Lopes et al., 2016; Soares et al., 2014).

There are a wide variety of mental disorders, all of which are worthy of attention, but we are specifically interested in those that may impact the student's educational performance by worsening mental health, like

depression and anxiety (Andrews & Wilding, 2004). It is not just a matter of grouping the mental disorder patients with each other in the educational system, or of including them among the other students; their individual needs must be considered responsibly and effectively (Asbury & Plomin, 2013). In general, behaviors can be designed according to their etiology taking into account that a single gene or a set of genes is responsible for one or more behavioral traits at the same time. These conceptions approximate beliefs in genetic determinism that go in the opposite direction to what has been scientifically discovered: a multifactorial set of genes interact with many environmental factors for the expression of each trait (Briley et al., 2018).

Investigations about human beliefs about behaviors etiology have been carried out over the years, focusing on civilians (Gericke et al., 2017; Human Genetics Commission, 2001) and also on teachers (Antonelli-Ponti et al., 2018; Castéra & Clément 2014; Crosswaite & Asbury 2018; Walker & Plomin 2005). In all the teacher samples, people believe in genetic determinism explicitly (Antonelli-Ponti et al., 2018; Antonelli-Ponti & Crosswaite, 2019; Crosswaite & Asbury 2018; Walker & Plomin 2005) or implicitly (Castéra & Clément, 2014). Mental disorders are conceived as inferior behavioral forms, with low probability of cure, and as immutable traits. Such conceptions about mental disorders accompany a “complex social process that involves labeling, stereotyping, separation, status loss and discrimination” (Ke et al., 2014, p. 329), which are the so-called social stigmas. The mental disorder stigmas in the school environment are expressed as the isolating and negatively stereotyping behavior of the "normal" group, among other damages (Ke et al., 2014).

Brazilian data on the teachers' perception of the genetic and environmental influence on behaviors relevant to the educational process, including mental disorders, intelligence, personality, learning difficulties, and behavioral problems, have been previously reported by Antonelli-Ponti et al (2018). Considering the problem of social stigmas about mental disorders, we now analyze teachers' perceptions focusing on mental disorders, exploring the relationships among the groups of teacher and categories of response, and the importance attributed by teachers to each factor.

Method

This was a quali-quantitative study with a cross-sectional design. The participants were contacted for convenience according to the proximity of the schools. The questionnaire was answered within the school in 2014 and 2015 with paper and pen in the presence of the principal researcher, which informed them about fill instructions and about the research.

The project was approved by the Ethics Committee in Research on Human Beings of the institution (Document n° 771.808) and all subjects gave written informed consent to participate in the study and were aware of the confidential nature of the research.

The research instrument was originally applied to parents and teachers in the United Kingdom (Walker & Plomin 2005). Considering the differences in language and culture, the questionnaire was translated and adapted to the Brazilian reality (Antonelli-Ponti et al., 2018).

For the purposes of the present study, only the items related to the teachers' perception about the etiology of mental disorders were analyzed.

Sample

The study sample consisted of 501 Brazilian teachers of all educational levels. Most of the sample consisted of women (72.1%) and mean age was 40 years (range: 22-67 years). Approximately half the sample only concluded the undergraduate course that enabled them to be a teacher (46.8%) and the other half continued their studies, with postgraduation (36.2%), a master's degree (10%), or a doctorate and postdoctoral training (6.2%). About the areas of knowledge, 67.7% of participants studied areas related to human sciences, 36.2% studied biological sciences, and 14.9% exact sciences. Their teaching experience ranged from zero to 43 years. Most participants declared that they had some knowledge about genetic influence on human behavior (69.5%) and 49.7% declared that they studied aspects of genetics during their teacher training (Antonelli-Ponti et al., 2018).

Instrument of Research and Data Analysis

Participants were asked to answer the questions in Brazilian Portuguese:

Question 1:

How do you think mental disorders are influenced by genes or by the environment?

- only genes
- more genes than environment
- genes and environment in equal parts
- more environment than genes
- only environment

Question 2:

Considering 0 for no influence and 10 for maximum influence, mark a number on the scales below that best corresponds to the importance you attribute to environmental influence and genetics on mental disorders.

Genetics: 0 - 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10

Environment: 0 - 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10

In the first question, the assigned numbers ranged from 1 ('only genes') to 5 ('only environment'). The items compared different demographic groups of teachers (Sex, Age, Years of study, Area of Knowledge, Income, Years of teaching, Knowledge of Genetics, Studied Genetics) regarding the category of response: Only genes (1), More genes than environment (2), Genes and environment in equal parts (3), More environment than genes (4), Only environment (5). It is worth noting that for conducting analyzes Age, income and length of experience were divided into quartiles and categorized into ranges. The graduation of the participants was placed in the group of their respective area of knowledge.

The second question is a development of the first. The participants assigned a number from 0 to 10 to genetics and to the environment, demonstrating in more detail the importance they attribute to each factor. The numerical scales were analyzed descriptively and quantitatively.

Results

Question 1: Group Analysis

Exploratory and categorical analysis of the data was conducted using the SAS software version 9.3 2010. To this end, a contingency table containing the frequency of responses in absolute numbers was constructed for each of the sample group and each item of question 1 (Table 1). The data set available in the contingency table were plotted on axes and generated correspondence maps (Figure 1) in which closer variables represented more frequent joint occurrences. The codes of the sample groups and the items of question 1 in the correspondence map (Figure 1) are described in Table 1. These codes are the same which was used in aggregate analysis of teachers' perceptions about five behaviors relevant in educational process (Antonelli-Ponti et al. 2018).

Table 1

Frequency of groups' responses to question 1 regarding genetic and environmental influences on mental disorders.

Items		Only genes	Genes > environ	Genes = Environ	Genes < environ	Only environ
Groups	Codes	IGA1	IGA2	IGA3	IGA4	IGA5
Female	G1	144	162	41	9	1
Male	G2	45	76	16	1	0
Age group 1 (20-32)	I1	56	57	12	2	0
Age group 2 (33-39)	I2	45	48	10	1	0
Age group 3 (40-48)	I3	38	58	17	2	1
Age group 4 (49-67)	I4	41	45	10	3	0
Only graduation	E1	101	109	18	3	1
Graduation plus other courses	E2	64	85	28	3	0
Master's degree	E3	15	29	9	1	0
Doctorate/ postdoctoral training	E4	10	15	2	3	0
Human Science	AC1	116	126	26	4	17
Biological Science	AC2	25	35	8	1	4
Exact Science	AC3	22	28	7	1	3
Income group 1 (R\$1.000,00 a 3.910,00)	R1	48	40	11	1	1

Table 1 (continued)

Income group 2 (R\$3.911,00 a 5.230,00)	R2	38	52	12	0	0
Income group 3 (R\$5.231,00 a 8.000,00)	R3	34	69	16	4	0
Income group 4 (R\$8.001,00 a 25.000,00)	R4	31	38	10	3	0
Years of teaching 1(0- 5)	TA1	64	57	12	3	0
Years of teaching 2 (6-10)	TA2	35	58	17	2	0
Years of teaching 3 (11-20)	TA3	47	68	15	2	1
Years of teaching 4 (21-43)	TA4	43	55	12	3	0
Studied genetics	EG1	87	126	28	6	1
Did not study genetics	EG2	104	112	29	4	0
Know genetics	CG1	129	170	42	8	1
Do not know genetics	CG2	62	68	15	2	0

(Reproduced from Antonelli-Ponti, 2016).

The correspondence map (Figure 1) shows that no group was associated with the "only environment" item (IGA5), and there is a marked clear division between this item and all others that consider the genetic factor, i.e., "only genes" (IGA1) "more genes than environment" (IGA2), "genes and environment in equal parts" (IGA3) and "more environment than genes" (IGA4). In addition, other important group-item associations were described: Several groups of teachers (with the exception of groups formed by area of knowledge: AC1, AC2 and AC3) are distributed around the items containing the genetic factor ("only genes" - IGA1 - "more genes than environment" - IGA2 - "genes and environment in equal parts" - IGA3 - and "more environment than genes" - IGA4) or the "genetic" side of the map. The "only environment" item (IGA5) appears on the opposite side of the map and was not associated with any of the sample groups.

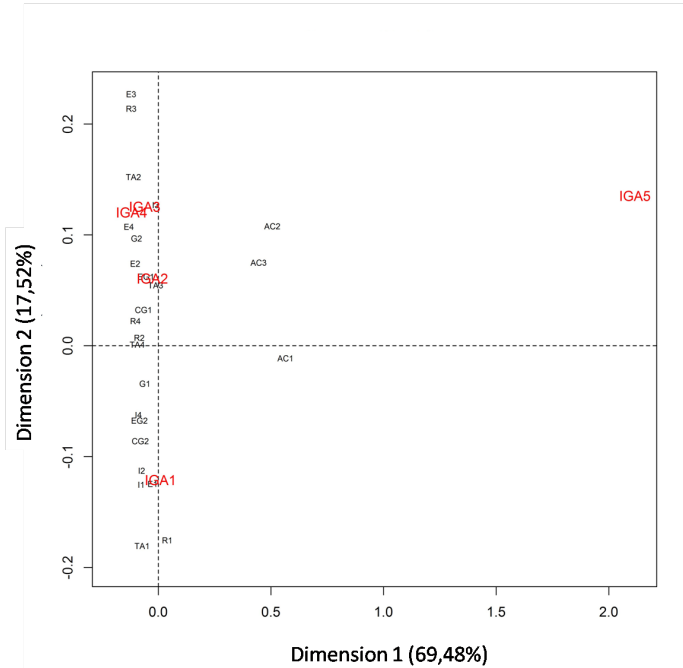
The younger teachers (I1 and I2) were associated with the "only genes" item (IGA1), the middle age group (I3) was associated with the "genes and environment in equal parts" and "more environment than genes" items (IGA3 and IGA4).

Teachers with less study time (E1) were more associated with the "only genes" item (IGA1); teachers with a little more time of study (E2) chose the "more genes than environment" item (IGA2); E3 was positioned at the top on the map, without important association with any perception, and finally the group with more years of study (E4) was associated with the "more environment than genes" item (IGA4).

The groups of teachers who studied aspects of genetics during teacher training (EG1) and who reported knowing aspects of genetic influence on behaviors (CG1) were associated with the "more genes than environment" item (IGA2). In contrast, the group that did not study genetics (EG2) and the group that declared that they had no knowledge of the genetic influence on the behaviors (CG2) were closer to the deterministic item "only genes".

Figure 1

Correspondence Map of the items of question 1 regarding teachers' perception about genetic and environmental influences on mental disorders, and the sample groups¹



¹IGA1=only genes; IGA2=more genes than environment; IGA3=genes and environment in equal parts; IGA4=more environment than genes; IGA5=only environment. G1=Female; G2=Male; AC1=human sciences; AC2=biological sciences; AC3=exact sciences; EG1=studied genetics; EG2=did not study genetics; CG1=knows genetics; CG2=does not know genetics; E1=complete higher education; E2=complete higher education with postgraduate; E3=master's degree; E4=doctorate and postdoctoral; R1, R2, R3 and R4=income ranges in increasing order; I1, I2, I3 and I4=age ranges in increasing order; TA1, TA2, TA3 and TA4=years of teaching in increasing order.(Reproduced from Antonelli-Ponti, 2016).

Question 2: Quantitative Analysis

The numbers of the scales were grouped from 0 to 3, 4 to 6 and 7 to 10, to facilitate the visualization of the results (Table 2). The percentage of responses from seven to 10 to the genetic scale were higher (84.7%) than the percentage of responses from zero to six to the environment scale (81%) (Table 2).

Table 2

Percentage of responses, mean, standard deviation and size of the numerical effect on the influence of genetic and environmental influence on mental disorder (n=501).

	0 - 3	4 - 6	7 - 10	Mean	SD	Size effect (D*)
Genetics	1.3%	14.0%	84.7%	8.38	1.79	
Environment	49.6%	31.40%	19%	3.67	2.82	
						1.23

*Cohen’s $d = \frac{|m1 - m2|}{\sqrt{s^2_1 + s^2_2 - (2rs_1s_2)}}$

The distance between the scale for genetic influence and the scale for environmental influence, i.e, the distance of the perception between the weight of the genetic influence and the weight of the environmental influence was quite expressive (D=0.95) (Table 2). A large effect starts with $d = 1.23$. In addition, the negative correlation between the scales was low, but significant ($r = -0.25$ $p < 0.001$) showing that, to some extent, while one variable increases the other decreases. The mean comparison test showed a statistically significant difference between the genetics and environmental scales (Table 3).

Table 3

Mean comparison test between the genetics and environmental numerical scales

	Paired Samples Test				
	95% Confidence interval				
	Inferior	Superior	t	gl	p
Genetics/ Environment	4.32	4.99	27.1	500	.001

Results regarding teachers who expressed extreme responses about the etiology of mental disorders are shown in Table 4. Mostly, responses were in favor of genetics and denied the environment. A small percentage of teachers expressed the same weight for the two domains: low values attributed to either

all environment or all genes in an interactive vision. Just a small percentage of responses attributed 10 for environment.

Table 4

Percentages of simultaneous responses to extreme values on numerical scales from 0 to 10 to the degree of genetic or environment influence on mental disorders.

Genetics	Environment	% of simultaneous responses
10	10	1.4
10	0 (zero)	17
0 (zero)	10	0.2

Discussion

Our evaluation of Brazilian teachers' perception about the etiology of mental disorders revealed a belief in genetic determinism by a substantial part of the sample. On the one hand, this result was expected, given the well-known stigma that society imposes on mental disorders (Ke et al., 2014), as well as the relationship between beliefs and stereotypes (Soares & Bejarano, 2009). On the other hand, it is which reveals the need for proper dissemination of this research area.

The term Mental Disorders was adopted in the process of adapting the instrument from UK to Brazil, as it seemed to be the most appropriate and equivalent to the original mental illness. However, we know that it is a broad term and, therefore, it can incorporate a diversity of diseases according to the culture and knowledge of the sample, therefore, the difference between the current result and that found by Walker and Plomin (2005) is justified. For the purposes of this study, considering the relevance in the educational environment, the breadth of the term was adequate, since it refers to any disorder capable of affecting the social relationship and educational performance of the student.

The genetic determinism to mental disorders by our sample appeared at various points in the analyses performed. First, there was a concentration of responses on just one factor which can influence mental disorders. We

interpret these data as reflecting the lack of understanding of our participants about the interaction and correlation phenomena between gene and environment and their probable ignorance about the epigenetic mechanisms that may influence the expression of such mental conditions (Nestler et al., 2016; Plomin et al., 2011; Uher & Zwickler 2017). Second, the comparison between the mean values on the numerical scales that scored the perceived degree of influence of genes ($M = 8.38$) and the environment ($M = 3.67$; Table 2). This higher perception in favor of genetic influence had already appeared in the question 1 ($M = 1.78$) in the previous survey with this same sample of teachers (Antonelli-Ponti et al., 2018). The difference between genetic and environmental scales was significant ($p < .001$; Table 3). In addition, 38.4% of teachers scored "only genes" on the question 1 (Antonelli-Ponti et al., 2018) and 17% scored, at the same time, 10 for genetics and 0 for environment on the zero to 10 scale, reiterating the belief of this participants sample in the genetic determinism on mental disorders (Table 4). The behavior of this sample of Brazilian teachers is equivalent to that of a sample of civilians (lay persons) in the United Kingdom regarding two genetically influenced diseases, sickle cell anemia ($M = 1.84$) and Huntington ($M = 1.72$), using a similar scale from 1 (genes) to 5 (environment) (Human Genetics Commission, 2001).

The result of the correspondence analyses is shown in Figure 1. The distribution of several groups of teachers (with the exception of groups formed by area of knowledge: AC1, AC2 and AC3) is around the items containing the genetic factor (genes only - IGA1 - more genes than environment - IGA2 - genes and environment in equal parts - IGA3 - and more environment than genes - IGA4) or the genetic side of the map. The only environment item (IGA5) appears on the opposite side of the map and does not associate with any of the sample groups.

Regardless of the area of knowledge, there was no strong association with any of the items or with other groups, not even the one that contemplates biology teachers (AC2) (Figure 1). The area of knowledge seems to be irrelevant for the establishment of perceptions about the dual influence of genes and environment on behaviors, with the impressions being as explicit as those that emerge from stated issues on the subject (case of the present study) or being implicit (perceptions are captured regardless of the theme) (Castéra & Clément 2014).

An age effect was noted on the perception in favor of genes or in favor of the environment regarding mental disorders, analyzed separately. Brazilian university students attributed a slightly greater influence to the environment than to the genes on depression, equal influence on bipolar disorder, and in favor of genetics on schizophrenia and attention deficit and hyperactivity disorder (ADHD) (Gericke et al., 2017). Depression was considered by UK people under the age of 25 to be more influenced by environmental factors, while older people attributed more influence to genetics (Human Genetics Commission 2001). Our Brazilian teachers' sample behaved differently in relation to mental disorders: the younger ones are more deterministic, the middle-aged ones are just in the middle of perception and the older ones attribute a greater influence to the environment (Figure 1). The age effect in our sample is more consistent with the literature regarding epilepsy, a disease to which younger people attribute greater genetic influences while older people tend to attribute a greater influence to the environment (Human Genetics Commission, 2001).

In our view, the numerical scale analysis (Table 2, Table 3) revealing a tendency to the beliefs in genetic determinism is alarming, since 50% of the teachers studied aspects of genetics during their teacher graduation (Antonelli-Ponti et al., 2018). Approximately 70% of them reported having knowledge about genetic influence on human behaviors (Antonelli-Ponti et al., 2018). In the UK teachers' sample cited above, who responded to the same instrument as the present one, only 20% had studied aspects of genetics during their teacher training. They, however, were teachers of twins who participated in the Twins Early Development Study (TEDS), which may have given them information on how genes and environments shape behavioral development. Their responses were different from those of the Brazilian teachers reported here and were more similar to scientific findings ($M=2.39 - 1$ to 5 scale), indicating the influence of both genetic and environmental factors (Walker & Plomin, 2005).

The categorical exploratory data analysis based on sample groups and the items from 1 to 5 in a correspondence map seems to have a different effect on perceptions, years of study and knowledge of genetics. The perceptions of teachers with fewer years of study, without knowledge and without information about genetics lead to greater genetic determinism. More years of study, knowledge and information about genetic, increase the perception

about the role of the environment in mental disorders (Figure 1). The effect of the years of study, as found in a study with teachers from 23 countries (Castéra & Clément, 2014) demonstrates the importance of continuing teacher education. The effect of genetic knowledge demonstrates the importance of promoting teacher training courses in order to inform them about the genetics of human behavior, with emphasis on relevant behaviors in the educational process (Crosswaite & Asbury, 2018). The environment promoted by the teachers themselves and the school environment has an effect not only on performance but also on the quality of life of students (Asbury & Plomin, 2013). If teachers' beliefs about the etiology of mental disorders were negative and stigmatizing or neutral, but used to justify the students' performance (Heine et al, 2017), teaching practices for the group and individualized teaching practices can be useful (Ponti et al, 2020) to promote inclusion in classroom.

Canada's Center for Addiction and Mental Health (2001) has set up a guide for teachers to inform and empower them to speak to their students so that positive changes are promoted in both the knowledge and the attitudes of students regarding mental disorder. Werler et al (2020) found positive effects on universal school-based interventions. An intervention for youngsters of school age, in a classroom format allied to the use of videos with people reporting on how they live with mental disorders or how they overcame such conditions, demonstrated efficiency in the alteration of the desire for social distance and in the possibility of modifying stigmas about mental disorders (Ke et al., 2014).

One limitation of our study is that the research instrument did not ask participants how they conceptualize mental disorders (e.g., what are mental disorders; mental disorders are formed by one or more dimensions, etc). If they were thinking about mild depression or schizophrenia, two very different mental disorders, with different heritability (Plomin et al, 2011), it could influence their perception. Nevertheless, it's highly possible that they have put everything in the same package. The number of similar responses (Table 1) and the clustering pattern of the sample groups which suggest a strong perception of genetic correlation among the disorders (Figure 1) corroborating to previous findings suggesting a strong genetic correlation among the disorders (Plomin et al., 2016) and the existence

of one general factor (factor p) which, regardless the diagnose, explained the whole dimension of mental disorders (Selzam et al., 2018).

Data reported in a previous study by our group have shown that 93.8% of teachers in this sample declare that their teaching method would be affected if they knew that one of their students had a genetically influenced learning disability (Antonelli-Ponti et al., 2018); however, it is not known how the method would be affected. Teachers declare to feel more secure in dealing with students with disabilities or mental disorders if they are properly trained for this, both in terms of knowledge about the nature of the condition and of the students' necessities (Wehmeyer et al., 2000; Soares et al., 2014). Combining this information with the deterministic results obtained in the present study, training interventions should be considered in future studies. These can be used to train teachers to deal with their students and to explore the environmental possibilities of educational stimuli, as well as to test the effectiveness of each form of intervention in modifying deterministic teacher beliefs.

Although this study did not measure the stigmas associated with mental disorders or even teachers' knowledge about the subject, it points to a potential source of stigma formation and loss of self-confidence among students when they receive from their tutors signs that eventual difficulties cannot be overcome. In this respect, a complementary study perspective would be the investigation of the relationship between the stated perceptions and the teaching style of the teachers evaluated, which should also be considered in future studies.

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