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A candle in the dark: validity evidence for the Belief in Science Scale

Uma vela na escuridão: evidências de validade para a Escala de Crença em Ciência

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Abstract

Objective
The Science Belief Scale was developed with the aim of measuring the phenomenon in question, comprising 10 statements related to science and its associated worldview. This manuscript seeks to examine the psychometric properties of the instrument within the Brazilian context, with a particular emphasis on validity evidence.

Method
A translated and culturally adapted version of the instrument is presented, accompanied by an exploratory factor analysis (n = 662), as well as correlations between belief in science and personality traits, rationality, religion, sex, age, and educational attainment. Additionally, mean comparisons of science belief scores across religious groups were conducted.

Results
The findings indicate that the scale demonstrates robust internal and external validity, and given the assessed statistical power, the generalization of results appears justifiable with a reasonable degree of confidence.

Conclusion
The evidence of validity found in the study suggests that the satisfactory psychometric qualities of the scale for the Brazilian context may support new and broader investigations into individuals' relationship with science as a belief.

Keywords: Belief; Psychometrics; Religion and science; Reproducibility of results.

Resumo

Objetivo
A Escala de Crença em Ciência foi criada numa tentativa de mensurar o fenômeno em questão, apresentando 10 afirmações relacionadas a ciência e a esta visão de mundo. Este manuscrito busca avaliar as qualidades psicométricas do instrumento para o contexto brasileiro, focando principalmente nos indícios de validade.

Método

Apresenta-se uma versão traduzida do instrumento que contou com a adaptação ao contexto brasileiro, além da realização da análise fatorial exploratória (n = 662), correlação entre crença e traços de personalidade, racionalidade, religião, sexo, idade e escolaridade, além de realizar a comparação entre as médias da crença em ciência de grupos religiosos.

Resultados

Os resultados sugerem que a escala possui bons indícios de validade interna e externa e dado o poder estatístico avaliado, é possível considerar a generalização dos achados com alguma segurança.

Conclusão

Os indícios de validade encontrados no estudo sugerem que as satisfatórias qualidades psicométricas da escala para o contexto brasileiro podem embasar novas e maiores investigações acerca da relação dos indivíduos com a ciência como uma crença.

Palavras-chave: *Crença; Psicometria; Religião e ciência; Reprodutibilidade dos testes.*

Although science is not inherently a traditional belief system, it has been observed over the years that non-religious beliefs can give rise to phenomena commonly associated with religion. This includes serving as a source of comfort, meaning, and other compensatory functions (Faria et al., 2013; Rutjens et al., 2009; B. T. Rutjens, J. van der Pligt et al., 2010; B. T. Rutjens, F. van Harrevald et al., 2010; Sagan, 2006). Consequently, the hypothesis put forth by Farias et al. (2013) suggests that belief in the value of science, both as an institution and as one of the many forms of knowledge, may serve a similar comforting role as secular belief in religion. The Belief in Science Scale (BISS) aims to assess an individual's belief in science through self-declared questions regarding agreement/disagreement and, notably, the extent to which science can address specific questions or support their worldview.

This study presents an adapted version of the BISS instrument for the Brazilian context, as well as an evaluation of transcultural validity, discriminant validity, construct validity, content validity, and criterion validity indicators. The study also sought to assess the relationship between belief and other constructs and factors, such as religion, level of education, and biological sex. Furthermore, the study compares belief means among different religious groups.

Theoretical Framework

The Belief in Science

In addition to the relationship between reason and intuition in the decision-making process, there is evidence suggesting significant correlations between personality traits and religiosity or belief (Homayouni, 2011; Khoynezhad et al., 2012). Findings from Faria et al. (2013) and Shenhav and Greene (2011) indicate that a higher inclination toward intuitive thinking is associated with increased religious belief, while analytical thinking, conversely, tends to correlate with heightened religious or magical disbelief.

The discourse surrounding science as a belief, whether in the context of challenging or affirming other beliefs, is not a recent phenomenon, and certain occurrences highlighted by Machado et al. (2019) continue to be apparent in contemporary communication media. Where there exists belief, there is also a counterpart of disbelief. Some indications regarding the origins of scientific disbelief, as noted by Rynes et al. (2018), might arise from analytical errors or even questionable research practices involving the falsification of data or results. Additionally, disbelief may be associated with ideological polarization, prompting individuals to seek guidance from those who share similar beliefs (Marks et al., 2019).

Similar to belief, Rutjens et al. (2018) provides evidence of scientific disbelief, often associated with religious beliefs or even more conservative political views (Lewandowsky & Oberauer, 2016), as well as various conspiratorial ideas (Lewandowsky et al., 2013). In general, there are a considerable number of studies and evidence that analytical thinking is related to religious disbelief (Gervais & Norenzayan, 2012; Stagnaro et al., 2019), while religious belief is more related to intuition and, in turn, to automatic and heuristic processes.

Such findings do not imply that diverse beliefs cannot coexist within the same individual, nor do they suggest that these beliefs are entirely contradictory, so an individual can commonly hold multiple beliefs without internal conflicts. Occurrences like the one described were observed by Irwin et al. (2015) concerning a supposed doublethink. The researcher suggests that this type of doublethink (believing in science and believing in the paranormal) would occur in a compartmentalized manner, maintaining both forms of thinking simultaneously.

Another example in this context is related to the study by Machado and Zangari (2016), where Kardecist spiritists and Catholics used rational argumentation and scientific foundations to justify phenomena and align their beliefs. A similar situation was discussed by Krauss and Colombo (2020), suggesting that ambiguous evidence can be interpreted as supportive of a conclusion.

Brazilian Scientific Literacy and Belief in Science

The discussion regarding the possibility that scientific education may or may not reduce belief in paranormal phenomena was conducted in the study by Maraldi et al. (2016). While there are suggestions that belief in the paranormal decreases with an increase in scientific literacy, there is also evidence suggesting no relationship between belief in the paranormal and scientific literacy (Broch, 2000). Formal knowledge indices and, consequently, scientific literacy, are low in Brazil. According to the Estudos e Pesquisas Educacionais Anísio Teixeira (INEP) (Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira, 2017), indices of numeracy literacy and knowledge about science, along with the number of years of education, are lower compared to other countries.

In this study, the adaptation of the Belief in Science instrument to the Brazilian context was conducted with the goal of identifying indicators of internal validity (convergent, discriminant, content, and transcultural) and external validity derived from the concept of the nomological network (Pais-Ribeiro, 2013; Pasquali, 2007). This is considered in light of the understanding that belief in science is associated with religiosity, personality traits, rationality, and biological sex. A study by Machado et al. (2019) has already employed a version of the scale and reported results of exploratory factor analysis as an indicator of psychometric quality, along with the agreement index among judges. This manuscript is not a replication of that study. This study aims to discuss the indicators of validity observed along with the results of the adaptation process, evaluation by judges and experts, factor analysis, analysis of correlation between variables, and comparison of group means.

Method

Adaptation to the Brazilian Context

The importance of adaptation and the implementation of additional methodological procedures, which are much more complex than the literal operationalization of a translation, is

emphasized by Borsa et al. (2012) and Sireci (2005). Their guidance revolves around avoiding the compromise of construct validity and promoting the preservation of the concept attributed to the instrument. Therefore, we chose to conduct a new translation procedure as one way to observe evidence that the content of the item has been retained and is suitable for the Brazilian context.

Hence, some procedures guided by Borsa et al. (2012) involve forward and back translation, synthesis of versions, evaluation by judges, evaluation by the target audience, pilot study, and the evaluation of the factorial structure of the instrument. These steps assist the researcher in attempting to retain the context and observe indications of validity. The initial translation was performed by an experienced professional with a Bachelor's degree in Languages and Translation, along with free translations by other individuals with recognized proficiency in the English language. Thus, the proposals for the use of multiple versions with bilingual translators unfamiliar with the construct were met (Beaton et al., 2000; Cassep-Borges et al., 2010).

To test consistency in a back translation situation (Beaton et al., 2000; Borsa et al., 2012, Sireci, 2005), the consensus version was submitted to two university students-native English speakers residing in the United States with Portuguese as their second language. The context in this process was maintained, and only a few terms were altered without compromising the meaning. It is also of interest to compare the version used by Machado et al. (2019) with this study's consensus version, as shown in Table 1.

When analyzing Table 1 in terms of convergence, it becomes evident that item 9 maintains an identical translation, while the wording of the other items varies slightly (e.g., from "rationally" to "in a rational manner"), without altering the context. Concerning item 2, the translation performed by the researchers omitted Sagan's (2006) metaphorical context but still preserved the essential context in the statement, where science is seen as a hopeful way to solve a problem (the light at the end of the tunnel or the candle in the dark).

Table 1
Comparison between the final research version with a different previously used version

Translation	
Research Version	Machado et al.'s Version, 2019
1. Science gives us a better understanding of the universe than religion	1. Science provides us with a better understanding of the universe than religion
2. In a world haunted by demons, science is a candle in the dark (Carl Sagan)	2. "In a world with so many superstitions and full of unfounded beliefs, science is like a light at the end of the tunnel" (Carl Sagan)
3. We can only believe rationally that which is scientifically verifiable	3. We can only believe in a rational manner that which is scientifically verifiable
4. Science tells us everything there is to know about reality	4. Science is sufficient to explain what reality is
5. All challenges faced by humans can be resolved through science	5. Every task encountered by human beings can be resolved through science
6. The scientific method is the only reliable path to knowledge	6. The scientific method is the only reliable path that leads to knowledge
7. The only real kind of knowledge we can have is scientific knowledge	7. Scientific knowledge is the only true kind of knowledge we can have
8. Science is the most valuable part of human culture	8. Science is what is most valuable in human culture
9. Science is the most efficient means of reaching the truth	9. Science is the most efficient means of reaching the truth
10. Scientists and science should have more respect in modern society	10. Scientists and science should be more respected in our society

The panel of judges consisted of three individuals with bachelor's degrees in Business Administration and one with a bachelor's degree in Economics, all pursuing master's degrees in Work

Psychology. Additionally, there were three Ph.D. students in Psychology and one individual holding a Ph.D. in Psychology. The significance of the number of individuals participating in the evaluation process and the scores assigned to the quality of the content is emphasized by Alexandre and Coluci (2011) to ensure the relevance, clarity, and pertinence of the items. They suggest a concordance rate above 90% among judges as a criterion for assigning content validity. Experts and judges were invited to assign scores on a scale from 1 to 5, where 5 represented very high concordance regarding the criterion, and 1 represented very low concordance. From there, the Content Validity Index was calculated, resulting in 93%, considering the number of scores of 4 or 5 in relation to the total items and responses.

Participants and Statistical Assumptions

Data collection took place between 2019 and 2020 in a study titled "*What do you think about science?*" totaling 662 observations. Among the collected information are sociodemographic data, the administration of the BISS instrument, a version of the IGFP-5 (Big Five), and an instrument measuring rationality/intuition (CRT, Cognitive Reflection Test). Groups with more than 20 individuals sharing the same religion were adopted. Religions with fewer than 20 respondents were consolidated into the "other" category. The grouped data can be observed in Table 2.

Table 2
Characterization of research participants

1 of 2

Characteristics	Distribution	
	n	%
Sex		
Male	293	44.0
Female	369	56.0
Education		
Middle School	75	11.0
Higher Education – Undergraduate	207	31.0
Higher Education – Postgraduate – Specialization	332	50.0
Higher Education – Masters	39	6.0
Higher Education – Doctorate	9	1.0
Age		
18-25	40	6.0
26-30	57	9.0
31-35	121	18.0
36-40	175	26.0
41-45	107	16.0
46-50	68	10.0
51-55	45	7.0
56-60	27	4.0
61-65	14	2.0
66-70	6	1.0
71-75	2	0.0
Geographical Region		
Midwest	162	24.0
Northeast	34	5.0
North	13	2.0
Southeast	399	60.0
South	54	8.0

Table 2
Characterization of research participants

Characteristics	Distribution	
	n	%
Religion		
Atheist/Agnostic	125	19.0
Catholic	228	34.0
Evangelical/Protestant	80	12.0
Kardecist	80	12.0
Cristian – Others	44	7.0
African-based	26	4.0
Others	79	12.0

Non-normality of the data could be a warning factor if the sample were small and exhibited heteroscedasticity (Chantarangsi et al., 2016; Ghasemi & Zahediasl, 2012; Hair et al., 2009; Miot, 2017; Pino, 2014). However, for this sample, procedures were adopted to proceed with the analysis, considering the size (n > 200 individuals) and indications of homoscedasticity. Another important observation to support this decision is that the skewness is above 1 and below 2 only in item 10, which, according to Miles and Shevlin (2001), could be considered for the continuation of the analyses, as this would not be indicative of significant bias problems. Also, the sample did not have missing values.

Analysis of the Box's M test showed that the null hypothesis was not rejected, considering the significance level of $p < 0.05$, indicating equality of variance among the items.

Results

Results from the analyses aim to support the discussion on the indications of the instrument's validity. Regarding internal validity, confirmatory and exploratory factor analyses will be utilized to observe indications of factorial, convergent (composite reliability and average variance extracted), and discriminant validity. For external and criterion validity, analyses of correlations and group difference comparison will be conducted from the nomological network perspective.

Exploratory and Confirmatory Factor Analysis

For the execution of Exploratory Factor Analysis, a sample of 662 individuals was used, and the factors were extracted using the Factor program version 10.10.03. The analysis employed the Robust Diagonally Weighted Least Squares and Minimum Rank Factor Analysis methods via parallel analysis (Damásio, 2012) with Promax rotation and suppression of values below 0.30, without indicating the number of factors to extract. In the humanities and social sciences, oblique rotations are generally used, given the conceptual assumption of a relationship between factors. This choice is rooted in the understanding that it is impossible to isolate factors adequately and entirely (Damásio, 2012; Tabachnick & Fidel, 2014).

The factorability of the matrix is observed by the Kaiser-Meyer-Olkin test (KMO = 0.92), and the Bartlett's Sphericity test (significant at $\chi^2 = 4252.6$; 45; $p > 0.000$). Both indices signal good evidence in this study, given the adequacy both to the assumption that KMO indices above 0.7 indicate good factorability (Damásio, 2012; Laros, 2004) and the detected significance in the sphericity test (Tabachnick & Fidel, 2014). The extracted factors showed loadings above

0.5 (Hair et al., 2009) and communalities above 0.3 and below 0.8, assumptions observed in the analysis. The proportion of variance explained by the instrument was 0.64 with the indication of only one factor.

A high Cronbach's Alpha ($\alpha = 0.96$) and Guttman's Lambda ($\lambda^2 = 0.97$) are observed, evidence that the instrument has excellent reliability indices (Marocos & Garcia-Marques, 2013; Souza et al., 2017). The same level of reliability index quality was observed for each individual question. Thus, the exclusion of items for the purpose of improving reliability levels becomes unnecessary.

To assess discriminant validity indices, the squared correlations of the items composing the scale were obtained for comparison with the average extracted variance. The mean of the squared correlations observed in the analysis was 0.40. Although the factor loadings are mostly high and above 0.50, their other indices (χ^2/ Degrees of Freedom ratio, CFI, TLI, RMSEA, and AVE), presented in Table 3 as model 1, did not show good results from the perspective of confirmatory factor analysis assumptions.

Table 3
Other indices of the analysis

Model fit indexes	Results	
	Observed	Expected
Chi-Square	385.35	-
Df	35	-
p-value	0.000	< 0.05
χ^2/Df	11.01	< 5
CFI	0.98	> 0.9
GFI	1.00	> 0.9
RMSEA	0.12	< 0.08
TLI	0.97	> 0.90
CR	0.94	0.70
AVE	0.61	0.50
α	0.96	> 0.70

Note: Expected indexes according to Brown (2006) and Hair et al. (2009). *Df*: Degrees of Freedom; CFI: Comparative Fit Index, GFI: Goodness of Fit Index; RMSEA: Root Mean Square Error of Approximation; TLI: Tucker Lewis Index; CR: Composite Reliability; AVE: Average Variance Extracted; α: Crombach´s Alpha.

As observed, the exclusion of items provides evidence of improvement in the indices presented in the analysis. Among the indicators, only the Root Mean Square Error of Approximation (RMSEA) would not fit within the expected parameters. However, it can be observed that, despite marginally located at its midpoint, the lower limit of the RMSEA is 0.08 and crosses the indicated value range. The discussion regarding the fit indices acceptance limits in various articles (Lai, 2019; Lai & Green, 2016; Xia & Yang, 2019) converges on the joint use of indices such as RMSEA, Tucker Lewis Index (TLI), Goodness of Fit Index (GFI), and Comparative Fit Index (CFI) to complement the decision-making process for model acceptance. As the other indices indicate good fit, it is possible to support the hypothesis of a good model fit, given the proximity of the RMSEA to the expected value.

Belief in Science and Its Correlations

In order to observe the relationships between belief in science and personality traits (Homayouni, 2011; Khoynezhad et al., 2012), analytical thinking (Gervais & Norenzayan, 2012; Sanchez et al., 2017), religiosity (Rutjens et al., 2018), biological sex, and level of education (Maraldi et al., 2016), a correlation analysis was conducted considering the variables observed in Table 4.

The observations were listed to demonstrate the relationship of belief in science with some of the factors and constructs listed in the literature and present in this study.

Table 4
Spearman's correlation of belief with other factors

Variables	Indices	
	Correlation	$p > 0.05$
Cognitive Reflection Test	0.051	0.189
Openness to Experience	0.157**	0.000
Agreeableness	-0.227	0.000
Conscientiousness	-0.159**	0.000
Extraversion	-0.107	0.006
Neuroticism	-0.017	0.694
Religion	-0.450**	0.000
Age	-0.103	0.009
Demographic region	0.073	0.070
Biological Sex	-0.237**	0.000
Education	-0.040	0.310
Evangelicals	-0.297	0.000
Atheist and Agnostics	0.450	0.000
Catholics	-0.103	0.008
Kardecists	0.021	0.582

Note: **Significant at $p > 0.01$.

The observed correlations range from weak (positively with openness and negatively with age, biological sex, agreeableness, and conscientiousness) to moderate (positively with the atheist/agnostic group and negatively with the evangelical group and religion). The variable "religion" comprises all religious manifestations present in the study. The variable considering the religious group was included in the table to measure its relationship with belief in science individually for some of the religions. The choice to individualize the observation of the relationship between some religious denominations was based on the number of respondents in the study, as well as the quantity and national representativeness of religions observed in the last census conducted in 2010, considering the four largest representations. Although some of the relationships appear almost negligible, they were included to assess some of the hypotheses suggested in the literature, which will be discussed later.

Comparison between Religious Groups and Belief in Science

In this study, in addition to grouping religious denominations according to their conceptual similarity, an equalization of the number of individuals per religious group was also carried out to compare the means among Atheists, Evangelicals, Catholics, and Kardecists. The sample was divided to ensure that each group in this study had a minimum of 80 individuals. Four groups were selected: Atheists, Catholics, Evangelicals, and Kardecists. These groupings comprise a significant portion of the religious denomination observations in this study and represent the four largest representations observed in the last Instituto Brasileiro de Geografia e Estatística (IBGE, Brazilian Institute of Geography and Statistics) census in 2010 (Instituto Brasileiro de Geografia e Estatística, 2020).

Through an ANOVA [$F(3.316) = 59.73$; $p < 0.05$] considering the robust test of equality of means, the null hypothesis – H0 that the groups have equal means was rejected. In the Post Hoc comparison, it is observed that there is equality only in the comparison between the Spiritist and Catholic groups, as seen in Table 5. What can be seen is that the means are mathematically different and show statistically significant differences in the comparison between the Kardecist and Catholic groups (which have statistically equal means) compared to the Atheist/Agnostic or Evangelical groups.

Table 5
Comparison between groups via Tukey's Test

Groups and significance	Means and subsets		
	1	2	3
Evangelicals	2.878		
Kardecists		3.548	
Catholics		3.648	
Atheists			4.859
Sig	1.000	0.911	1.000

Note: Considering n = 80 for each group.

Although the assumptions of normality and homogeneity of variances are violated, there is evidence that the impacts may be minimized, given that it is a sample with more than 200 individuals (Hair et al., 2009) and that showed good effect size indices (considerable partial eta squared of 0.36) and a power of 0.999 calculated via G*power 3.1.9.4.

Discussion

Initially, the research aimed to present a version of the BISS (Belief in Science) instrument and to subsequently evaluate the adequacy of this version concerning the requirements for instrument adaptation (Beaton et al., 2000; Borsa et al., 2012; Cassep-Borges et al., 2010; Sireci, 2005), supporting the hypothesis of good psychometric qualities of the instrument. The adaptation process with items close in terms of content to the original and a content validity index above 90% are indications of transcultural and content validity, antecedents to the good results observed in the research.

Regarding indications of internal validity, and more precisely considering the exploratory factor analysis performed in Study 1, the factorial structure had good factorability indices and a considerable explained variance of 64%, in addition to excellent reliability observed in its Cronbach's Alpha ($\alpha = 0.96$), converging with international studies (Dagnal et al., 2019; Farias et al., 2013; Irwin et al., 2015; Machado et al., 2019; Ståhl et al., 2016). The items showed high factor loadings, corroborating results observed in the study by Dagnal et al. (2019), as well as the other instrument indices indicating adherence to the technique used.

Convergent validity indications estimated by the Average Variance Extracted (AVE) and Composite Reliability (CR) (Valentini & Damásio, 2016) were also observed in the model. Regarding discriminant validity, the assumption refers to the observed AVE, which was higher than the squared correlations of the items. As there are no other factors, the comparison was made between the AVE and the square of the correlation between the items. The other indices also proved satisfactory and adhered to values considered for good fits (Hair et al., 2009; Kline, 2005).

On the indications of external validity, evidence is presented through the correlations found with other constructs and factors listed in the literature that were the subject of analysis in this research. This aligns with the concepts of the nomological network developed over the years, positing that convergent and discriminant validity are measurable by the level at which a construct relates to or differs from other constructs, factors, or criteria (Pais-Ribeiro, 2013; Pasquali, 2007; Vianna, 2015). Indications of convergent, discriminant, and criterion validity are the relationships that the construct in question exhibited in the tests conducted with the proposed variables. Such relationships are discussed in this section to compare the literature reference with what was observed in the research.

The relationships observed in Study 2 corroborate that there is a weak relationship between personality (considering personality traits in the theory of the Big Five factors) and belief. Also, religious belief or disbelief (comparing those who believe in some religion with those who are atheists or agnostics) showed no correlation with rationality, suggesting that analytical thinking did not reduce religious belief (Gervais & Norenzayan, 2012; Sanchez et al., 2017). In this manuscript, the employed rationality measure (CRT) did not show a significant correlation with belief in science, unlike observations from other studies that indicate a relationship between them.

Regarding the personality traits represented in this study by the IGFP-5 instrument (Big Five) in Brazilian context (Andrade, 2008), observations related to conscientiousness, agreeableness, and openness to experience stand out as the most relevant. Openness to experience is related to the level of curiosity and complexity of thinking, conscientiousness is related to perseverance and the pursuit of goals (Pervin & John, 2004), and agreeableness is related to the level of socialization and antagonism with other individuals (Hutz et al., 1998). Some of the observed relationships are similar to the definitions of science suggested by Popper (1972), based on the complex, creative, and less emotional (antagonistic and more rational) pursuit of understanding the world, but somewhat different from what is expected in terms of conscientiousness, a factor often observed in the literature as a predictor of academic performance (Nechita et al., 2015) and personal well-being in organizations (Dessen & Paz, 2010).

A significant relationship was also observed between biological sex and scientific belief, where scores presented by men showed a positive correlation with higher scores of belief in science compared to scores presented by women. Another observed and noteworthy fact is that the level of education showed no relationship with scientific belief, refuting the hypothesis that there was a correlation between the number of years of study and a greater belief in science, in line with the discussion by Maraldi et al. (2016). The evidence observed by Irwin et al. (2016) and Machado et al. (2019) suggests that, in the academic environment, religiosity coexists with the scientific method, so that those with a traditional affiliation (among those commonly found in Brazil) often separate the rationality behind science from their personal beliefs, a finding corroborated by this research.

The correlation with religious belief or disbelief also suggests that less fundamentalist or irreligious religious views positively relate to belief in science. Atheism and agnosticism, for example, showed the highest associations (r = 0.45). These findings in the Brazilian context corroborate international studies on the nature of belief and some of its relationships.

In Study 3, the means of belief among the main religious groups were compared, and it was observed that although there is a mathematical difference that can be ordered between Catholics, Kardecists Spiritists, and Evangelicals, such differentiation was not statistically significant. The significant difference occurred in the comparison between the Atheist and Agnostic group, which

presented the highest mean belief. The power and effect size, observed satisfactorily, could assist in comparisons with future studies.

In various areas, belief in science remains a field with few studies. In the realm of organizations and work, there are few studies on the scientific literacy of workers, and low scientific belief has not yet emerged as a notable problem. However, disbelief in science and the rational process gives way for a more reckless management that contradicts evidence-based management approaches and current organizational premises. Such a scenario of disbelief or scientific ignorance has also been observed by Cruz and Silva (2008), who comment on the prevalence of theories without scientific basis commonly used in organizations. The spread of theories without the use of the scientific method in organizations involves significant financial resources and stands as one of the many established market niches.

Some limitations of this work are linked to the fact that a scale was not used to measure the participants' level of religiosity, which might justify any positive or negative correlations of certain religious beliefs with belief in science at certain levels. It was not possible to observe on a scale at what point the levels of religious and scientific belief begin to converge or diverge. A measure of the coexistence of both beliefs can be explored in future studies. Religious syncretism (Andrade, 2019) is also a point of observation in research of this nature, as it is common to find individuals who declare themselves followers of one religion but engage in practices that would be attributed to other beliefs, making it complex to classify an individual's religious belief in a simplistic manner. Another important point concerns the representativeness of some religions that, although they may seem similar and often groupable at a macro level, have very distinct views when analyzed in more detail. Even within the same religious denomination, such as Catholics or Evangelicals, there are various subdivisions in terms of devotion, community grouping, or order. Therefore, more advanced studies may further refine the taxonomy and classification of religious manifestations in relation to their non-religious beliefs.

It is important to emphasize that belief in science does not necessarily imply scientific literacy or factual knowledge about how the scientific method is conducted. Therefore, no measures were used to assess the level of knowledge or familiarity with terms related to science that the surveyed individuals possessed. An open hypothesis is that, although the number of years of study has proven to be nonsignificant in its relationship with belief in science, the quality of education may still have some connection with the level of scientific belief.

Thus, it is concluded that the evidence points to good psychometric qualities of the instrument and that the construct of belief in science can be adequately measured for the Brazilian context. Such a possibility broadens research horizons in which this type of variable is relevant and still underexplored, such as in organizations. The good indices found in this study shed light on the instrument's applicability in the Brazilian context.

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