Science-religion dialogue in education: perceptions of Religious education teachers in a Roman-Catholic context

Abstract

This paper examines the relationship between science and religion in the education system of Roman-Catholic Portuguese society. In particular, we explored perceptions of the relationship between science and religion for religious education teachers. We surveyed 198 Portuguese religious education teachers about how they view science and religion. The questionnaires revealed a number of similarities: religious education teachers are highly involved in religious practices and exposed to science; they perceived a compatibility between science and religion; and they have an openness to dialogue between both. They do not adhere to anti-scientific perspectives, but they simultaneously try to limit what can be explained by science. Thus, an interpretative view of dialogue and/or integration seems to best explain the perceptions of religious education teachers of the relationship between science and religion. These findings allow a space of discussion, enabling teachers to possibly foster the science-religion dialogue in their contexts of pedagogical activity.

Keywords: Science; religion; educational curricula; religious education teachers

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The historical and political paths of science as well as that of scientific knowledge have been the subject of much epistemological writing during the second half of the 20th century. Authors such as Foucault (2003) have reflected upon questions such as the nature of science (NOS) and scientific knowledge in a materialist way, highlighting the relationship with culture, history, politics, economy and power. In spite of what seemed to be an ineluctable progression towards secularization or disenchantment in Western society, religion and faith continue to influence the worldview of many people (Lindquist & Handelman, 2011).

This research is focused on the relationship between science and religious worldviews as both science and religion share several themes and questions that may arise in a classroom context. If we look at the history of science and religion, we realize that issues such as the origins of the universe and of humanity, the Big Bang theory or the theory of evolution have been discussed both from a religious and scientific perspective (Poole, 2007). Furthermore, societal fracturing themes such as cryogenics, euthanasia or bionics are being currently discussed in newspapers and magazines. These articles attract a multitude of views, including religious and scientific, that educators absorb in their everyday life and subsequently form their own opinions. In the wake of projects such as ‘Learning about Science and Religion’ (LASAR Project, 2011), and a recent special issue concerning the intersectionality of teaching disciplines (Billingsley & Fraser, 2018), we are interested in exploring the perceptions of religious education teachers about the relation between science and religion. The religious curricula in Portugal contemplates

more intersections with science than the other way around ([Deleted for blind review (DFBR 2016a)]), hence the focus on these teachers in particular. More precisely, this research intends to analyse the perceptions of religious education teachers of the relationship between science and religion in a Roman Catholic context, and how these perceptions are associated with the teachers religious practice and/or exposure to science.

The relationship between science and religion

There are different views on how, and if, science and religion are compatible. For instance, dogmatic religious views are negatively correlated with scientific inquiry among students (Aflalo, 2013). Barbour (1990, 1997) presented a typology of the science and religion interface with four views: (i) conflict; (ii) independence; (iii) dialogue, and (iv) integration.

According to the conflict view, science and religion perspectives eventually meet at a given point but are perceived as incompatible. This view is closely related with the example that students with more orthodox religious beliefs showed reluctance in admitting the tentative nature of science and freedom of inquiry and considered culture and society superior to science (Aflalo, 2013). Nonetheless, perception of conflict might have different responses, such as: a salience and effectiveness of one worldview in the individual's set of cognitions and beliefs (Reiss, 2008); cognitive dissonance (Burris, Harmon-Jones & Tarpley, 1997); switching between perspectives (Billingsley, Nassaji, & Abedin, 2017), or cognitive polyphasia (Moscovici & Markova, 1998).

The independence view compartmentalizes science and religion as if they do not intersect. For instance, a social constructivist perspective suggests that science and religion can coexist because both look at reality in ways that are culturally-bound and, therefore, none of them is closer to the objective reality than the other (Upadhyay, 2010). They are both culturally

legitimate ways of accessing, knowing and representing reality, and, consequently, they can coexist without discord, as long as they do not intersect. Cognitive apartheid (compartmentalizing scientific knowledge for the classroom and exams, and religion for other aspects of daily life (Cobern, 1996)) is an example of independence. However, this independence does not contemplate the possibility of discussing both science and religion, and tends to overlook the fact that both representations of reality coexist in the same society and, for many, within the same person. Such independent coexistence can potentially lead to conflict and does not account for the axiological dimension of knowledge.

The dialogue view allows conflict between science and religion to be shaped so that both religious and scientific perspectives can be critically put into question and, eventually, changed (Bickmore, Thompson, Grandy, & Tomlin, 2009; Reiss, 2014). Taking the example of a Christian, it is about "making his theology and his cosmology consonant in the contributions they make to this world-view. However, this consonance (as history shows) is a tentative relation, constantly under scrutiny, in constant slight shift" (McMullin, 1981, p.52).

The integration view asserts the possibility/desirability to formulate a comprehensive metaphysics encompassing a coherent world view regarding creation and human nature, with three distinct versions (Barbour, 1990; 1997): 1) natural theology (God's existence being inferred from nature, with science helping our awareness of its evidence); 2) theology of nature (theology and science not sharing the same sources, but viewing scientific inputs as affecting doctrinal reformulation), and 3) systematic synthesis (both science and religion contributing to the development of an inclusive metaphysics).

During the teaching and learning, possibilities emerge for a dialogue between science and religion. More precisely, approaching NOS might provide epistemological reflections about

science (e.g., reflection about the limits of science, processes, instances and criteria of validation of scientific knowledge, etc. (Koksal & Cakiroglu, 2010). Interestingly, the way people make sense of science does not seem to be influenced by their scientific background (Aflalo, 2013; Fleener, 1996). On the contrary, it seems to be influenced by their religious background: a study within Jewish and Muslim students showed significant positive correlations between religious belief and the weight ascribed to culture and society, while significant negative correlations were found between religious belief and the support of the tentativeness of science and the liberty of inquiry (Aflalo, 2013). Interestingly, a survey by the Pew Research Center (2015), in the USA, reported that 59% of respondents acknowledged that, in general, science and religion are often in conflict, but 68% assumed that their own religious beliefs did not conflict with science.

The previous examples suggest a general lack of capacity to understand and conceive different approaches to the relation between science and religion**.** According to some authors (Billingsley et al., 2017; Billingsley & Fraser, 2018), this inability is due to a lack of what the authors coined epistemic insight, i.e., knowledge about knowledge, which promotes cross-disciplinary relationships for students instead of compartmentalized curricula. However, little is known about socio-psychological approaches to dialogue between science and religion. Premises from Barbour's typology (1990, 1997) have been used for pedagogical interventions (e.g. Billingsley, Taber, Riga, & Newdick, 2013), but never empirically tested, to our knowledge (see, however, a recent and insightful approach to students' beliefs and attitudes; Konnemann, Höger, Asshoff, Hammann, & Rieß, 2018). Such a test would have implications for science education, as teachers are essential actors in the education system. They usually have a solid academic training and some room for freedom in their teaching for personalizing pedagogic practices, in spite of following the curricular standards. Therefore, the teachers own attitudes and beliefs end

up being brought to the classroom as well, thus shaping what is learned, and how it is learned by students. Though courses in school might be compartmentalized, life is not: as students construe their worldviews – which include a clear idea of the role of science and religion in their lives – they assemble what was brought to them disconnected (Billingsley & Fraser, 2018). Ignoring the interconnections between issues addressed both in science and religion leaves them on their own, or with potentially biased views of their peers and/or media (including social networks).

Also, most of the known examples of science-religion intersection come from countries and education systems traditionally embedded in the Christian Protestant tradition (e.g. Aflalo, 2013; Bilingsley et al., 2017), with unknown transferability to Roman Catholic traditions, such as in Southern Europe (e.g., Portugal). A previous qualitative study of the Portuguese curricula (for a synthesis of the main findings, see DFBR, 2016a) showed that, at Keystages 2 and 3, the Religious education curricula offer opportunities for interdisciplinary dialogue on themes such as Sexuality and human growth; Ecology; and the Origin of the universe, to these themes can be added the Origin of humankind at Secondary education levels. Whereas religious education curricula provide teachers with clear opportunities to promote an interdisciplinary debate, there is no such interdisciplinary initiative in the Science curricula, with virtually no mention of religion. Portuguese religious education teachers might then be expected to address science and religion, as well as opportunities (or lack thereof) for relating both in their pedagogical practice. Additionally, this might account for a deficit in teaching and promoting critical thinking, as there is an imbalance in the Portuguese curricula when it comes to provide students with the skills or knowledge to engage in social-scientific debates on this matter of science and religion (DFBR 2016a). Apparently, the profile expected from students involving critical thinking and relational

skills upon finishing secondary education (Martins, Gomes, Brocardo, Pedroso, Carillo, et al., 2017) does not include the topic of science and religion.

Moreover, in previous research with Portuguese secondary school students ([DFBR], 2016b), relevant similarities and differences between them and English pupils were found. Although the view of conflict seems to be present in both Portugal and England, there was a striking difference between students, in that creationism and the literal reading of the Bible did not seem to be sources of conflict for the Portuguese students only. Given that Bible literality is different across Christian denominations (Hoffmann & Bartkowski, 2008; Schwadel & Johnson, 2017) there may be an influence on the extent to which Bible events are seen as compatible with science, when considering a Roman Catholic background. Specifically, we attempt to answer the following research questions:

- What perceptions of science and religion do religious education teachers have?

- How are religious beliefs, religious practices, and exposure to science associated with perceptions of science and religion?

Method

Participants and Procedure

A total of 198 Portuguese religious education teachers (Male = 88; Female = 111; Missing = 4, aged 31-66 years old (M = 47, SD = 6.80)) participated in a questionnaire. This sample corresponds to approximately 25% of the total number of Catholic religious education teachers in Portugal (Direção-Geral de Estatísticas da Educação e Ciência, 2017). They were approached in the context of a lecture about science and religion delivered by the first author and invited to participate by filling in a paper-and-pencil questionnaire. It is worth mentioning that

the participants attended the lecture by their own free will and more than 95% consented to take the survey. To avoid influencing the responses, data were collected before the lecture took place. Because participants were recruited during training, results could be influenced by volunteer biases. As Rosenthal and Rosnow (2009) comprehensively documented, participating volunteers differ from non- volunteers in a number of ways (e.g. sociability, need for achievement, motivation for approval) and a "random sample of the population from which they were recruited" (p.79) would have been ideal. As this was not possible, we still tried to overcome this limitation by following Rosenthal and Rosnow's (2009) recommendations (e.g. making the appeal for participation as interesting as non-threatening as possible, and made by a high-status person).

Slight differences in the number of cases, degrees of freedom or percentages for similar variables are due to a small number of non-responses from participants on a given variable.

Questionnaire

Three Likert-type measures on perceptions of both science and religion were included, as they were the only existing measures found. The questionnaire also included a set of sociodemographic items to further characterize the sample.

A first measurement about science and religion was translated from Taber et al. (2011) and consisted of 39 items using a five-point Likert-type scale from 1 (strongly disagree) to 5 (strongly agree), with a "do not understand" option as well (presented as "N"). As found for a previous survey with students, the psychometric properties of the scale were insufficient, showing low reliability and loading in many inconsistent factors ([DFBR], 2016b). Thus, we opted to keep the eight items considered statistically relevant in previous research ([DFBR], 2016b; 2019). Because reliability was still very low (α = .34) and it was not possible to extract

meaningful factors, items were not aggregated but rather analysed separately (see Table 1). One of items was used as a measure of religiousness: “I am NOT religious – I DO NOT have any religious beliefs”, being recoded as reversed for better interpretation of results.

A second measure was translated from Longest and Smith (2011), with originally four items using the same scale as the first measurement. Reliability increased greatly after excluding one item (α =.28 initially). The first item’s scores were reversed, and the last item was deleted. The final measurement was reliable, taking into account the small number of items and a reverse-scored item (α =.67).

The third measurement was created to assess predominantly perceptions of Roman-Catholics ([DFBR], 2016a) with 25 items, using the same scale as the previous measurements. As occurred previously with a sample of students ([DFBR], 2016b), the weak psychometric properties did not allow for creating a composite measurement, and thus, the data were analysed by item (Table 3). Additionally, to maintain consistency with the items previously analysed for students, the items removed for the student sample due to lack of understanding (e.g., items related to canonization) were not analysed here.

Finally, contextual and sociodemographic questions were asked: age, gender, education level, school location, teaching status, religious education, scientific interest and religious practice. The two questions regarding religious practice (“What is your position about frequent involvement in collective religious practice” and “What is your position about personal prayer”) could be answered in the following scale: “I do not do it”, “Less than once a month”, “Less than once a week”, “Once a week”, “More than once a week” and “Everyday”. Both items significantly correlated (r (185) = .42, p < .001); therefore, a common measure of religious practice was also created. Similarly, the three questions related to exposure to science (“How

often do you visit museums, scientific centres or spaces", "How often do you watch scientific programmes (tv, radio, internet)", and "How often do you read science-related texts (magazines, journals, books, internet)"). The first two items could be answered as the religious practice items, whereas the last item had different options, including "I do not", "Less than once a month", "Less than once a week" and "More than once a week". Because the measurement scale was not the same across the three items, an averaged composite measurement would not be interpretable. Therefore, items were z-standardized (having a mean of 0 and a standard deviation of 1) before creating a composite score. These three items were significantly correlated (*ps* > .001 for all correlations), and a common measurement was also created with 3 items (α =.67).

Data analysis

Data were inserted and analysed using SPSS (Statistical Package for the Social Sciences, version 25. Analyses included variable frequencies, descriptive statistics (mean and standard deviation), Cronbach's alpha (scale reliability), Pearson correlation (association between variables), and simple linear regressions (association between an independent/predictor and dependent/criterion variable).

Results

Contextual Information

Contextual data, to better characterize the religious education teachers, indicated that most of them identify as Catholic (96%), followed catechism (94%), are involved in collective religious practice (only 6% practise less than once a week), and pray regularly (only 4% pray less than once a week). The combined measure of religious practice corroborates the fact that this sample frequently and homogeneously engages in religious practice (*M* = 4.96, *SD* = 0.71).

Regarding their exposure to scientific content, only one participant stated that he/she does not visit science-related spaces (e.g., museums), whereas the remaining participants visit less than once a year (21%), less than once a month (46%), once a month (20%) or more than once a month (12%). Most of them read scientific literature (95%), with 34% reading more than once a week, and most of them attend scientific programmes, with 66% of participants attending more than once a month. The z-standardized measure of scientific interest corroborates that this sample shows, on the standardized values, moderate exposure to scientific content (M = .01, SD = .77).

As for their formal education, three of them have a Doctoral degree, 47 have a Masters degree, and the remaining have an undergraduate (5-year) university degree. The academic area chosen during secondary education was predominantly humanities (78%), followed by sciences (13%), economics (6%) and arts (circa 1%). Most of them were actively engaged in teaching at the time (98%) and have a long teaching experience, with 83% having more than 10 years experience.

The homogeneity of the sample might very well be explained by the recruitment criteria to work as religious education teachers in Portugal. According to the law, teachers usually need to have a degree in Theology and need in all cases to be approved by the bishop of the region (Diário da República, 2014) under Portuguese law. The sample of this study reflects the deficit of young professionals among teachers in Portugal. At present, opportunities to enter the career are scarce, presumably due to demographic decline, which is even more salient in Portugal than in most European countries (Pordata, 2018). For example, in 2018, only 48 of the 296 candidates who applied for a position as religious teachers were assigned a position (Rodrigues et al., 2019).

Teacher Perceptions

As stated previously, perceptions related to the first and third measurement are presented by item, while the second is present in a composite form.

Regarding the first measurement (adapting some of the items developed by Taber et al., 2011), most religious education teachers tended to disagree with statements such as: belief that the universe was created in the way the Bible describes, and the perception that the scientific and the religious versions of how the universe began cannot both be true. Moreover, a considerable percentage of those teachers tend to accept the Big Bang Theory (42% agree and 19% completely agree; see Table 1 for more details).

Simple regression analyses were performed with each item separately as a criterion to assess whether religious belief, religious practice and exposure to scientific content are associated/predict each statement/perception. Among these items, religious belief significantly predicted the perception that miracles can happen as religion describes (item 1), β=.14, t(190) =1.98, p =.05, explaining a small, proportion of variance, R^2 = .02, F(1, 191) =3.92, p =.05. Religious belief negatively predicted that religious ideas about how the universe began have been proved wrong by science (item 7), β=-.15, t(189) =-2.05, p =.04, explaining a small proportion of variance, R^2 = .02, F(1, 191) =4.21, p =.04. Finally, exposure to scientific content negatively predicted confusion about what to believe about how the universe and life began (item 6), β=-.16, t(180) =-2.15, p =.03, explaining a small proportion of variance, R^2 = .03, F(1, 182) =4.62, p =.03. In any case, these results need to be interpreted with caution, as the effects are small and it is not possible to establish clear causality with this study's correlational design. What is more informative is a general lack of associations between the predictors and the teachers' perceptions. This will be further addressed in the discussion.

The second measurement (Longest & Smith, 2011) is about the compatibility between science and religion, as previously described. Here, some participants indicated not understanding items (maximum three participants per item), and for each item, these participants were removed from analyses not to inflate the means because this option was coded "6". Thus, with values ranging from 1.50 to 5, the descriptive statistics show that scores fall predominantly in the midpoint of the scale and with little dispersion, showing that perceptions are tendentially not extreme and that the sample is quite homogeneous in its perception (Table 2).

Given the lack of variability in the overall scale, the same item-by-item exercise performed for the other measurements was performed for Measurement 2 as well, including the item not included in the scale and showing the items as presented to the participants (item 1 not reversed; Table 3). Possibly due to that lack of variability in responses, religious belief was not related with perceptions of compatibility between science and religion, neither was religious practice and exposure to scientific content. If taking each item of the measurement separately, there is, however, an association with a specific item. More precisely, exposure to scientific content negatively predicted a perception that scientific findings have strengthened thoughts on religion (item 2), β=-.17, $t(167)$ =-2.15, p =.03, explaining a small proportion of variance, R^2 = .03, $F(1, 166)$ =5.00, p =.03.

Finally, as summarized in Table 4, although not possible to create a common scale, the items from Measurement 3 tend to provide more information regarding teacher perceptions, probably because, as mentioned previously, the measurement aims at targeting perceptions from Roman Catholics specifically. As in Measurement 2, for each item, data from participants stating that they did not understand that given item were not included in order not to influence the results (it happened in nine of the items). Corroborating the results from Measurement 1,

showing that teachers integrated scientific contributions in their religious views, teachers also showed a general agreement with the theory of evolution (item 1) and the non-literality of the Bible (item 2) (see also items 8, 10, 11, 16 and 19, in Table 4). It is also important to note that as much as teachers acknowledged science, they tended not to be dazzled by it. For instance, they tended to agree that science offers no explanation for some events (item 3) (see also items 5, 6, and 12, in Table 4). Additionally, the positioning from teachers was more dispersed in terms of lack of scientific explanation as an essential part of miracles (item 4), (see also items 9 and 14, in Table 4). Finally, there might be a tendency to be critical of some fellow believers, as teachers tended to show moderate levels of agreement with statements such as "many believers still have a vision of the world as if Galileo and Darwin had never existed" (item 7, Table 4).

Providing more detail on the significant associations, the results show that belief significantly predicted the perception that the theory of evolution can be accepted by believers (item 1), β=.15, t(172) =2.05, p =.04, explaining a small proportion of variance, R^2 = .02, F(1, 173) =4.19, p =.04. Exposure to science also predicted this perception, β=.16, t(170) =2.05, p =.04, explaining a small proportion of variance, R^2 = .02, F(1, 171) =4.20, p =.04. Religious belief also predicted the perception that saints are important because they are an example of life (item 6), β=.18, t(159) =2.28, p =.02, explaining a small proportion of variance in scores, R^2 = .03, F(1, 160) =5.18, p =.02.

The predictor showing stronger associations with items was religious practice. It negatively predicted the perception that catechism teachers should have scientific training to sustain their logic (item 8), β=-.16, t(168) =-2.09, p =.04, explaining a small proportion of variance, R^2 = .04, F(1, 169) =4.39, p =.04. Religious practice also negatively predicted the perception that both religion and science have a dynamic character (item 5), β=-.18, t(164) =-2.34, p =.02, explaining

a small proportion of variance, R^2 = .03, F(1, 165) =5.46, p =.02. Additionally, it negatively predicted the perception that believers should know more about science to sustain reasons to have faith (item 10), β=-.20, t(173) =-2.74, p =.01, explaining a small proportion of variance, R^2 = .04, F(1, 173) =7.52, p =.01. Finally, it negatively predicted the perception that magic and superstition are part of religion (item 19), β=-.20, t(151) =-2.47, p =.01, explaining a small proportion of variance, R^2 = .04, F(1, 152) =6.12, p =.01. For this item, exposure to science content was also a negative predictor, β=-.17, t(143) =-2.11, p =.04, explaining a small proportion of variance, R^2 = .03, F(1, 144) =4.47, p =.04.

Interestingly, the items including statements about faith maturity were associated with exposure to science but not religious practice. More precisely, exposure to science was associated with the perception that a greater scientific culture might lead to a more mature religious practice (item 11), β=.15, t(172) =2.05, p =.04, explaining a small proportion of variance, R^2 = .02, F(1, 173) =4.19, p =.04. Additionally, exposure to science was associated with the perception that scientific culture contributes to a mature faith (item 12), β=.28, t(151) =3.56, p <.001, explaining a larger proportion of variance, R^2 = .07, F(1, 152) =12.66, p <.001.

Discussion

The current research aimed at answering research questions on what religious education teacher perceptions of science and religion are, and how are religious belief, religious practice, and exposure to science associated with perceptions of science and religion. As teachers do not leave their own attitudes and beliefs outside the classroom, it is important to understand these perceptions, and reflect on how they can influence the teaching of both science and religion. Our work aimed at contributing to understand how religious education teachers can bridge their teaching with science.

The findings must be discussed within the complex context of a Roman-Catholic society, such as Portugal, where the adherence to a religious worldview is stronger than in other countries, for example traditionally Protestant nations or those nations having more religious diversity (e.g. Norway, Chile) (Vilaça, 2001). Moreover, according to Fernandes (2003), Portuguese people have stronger religious beliefs than the European Union average and, interestingly, than Spain, France and the United Kingdom, except in beliefs concerning telepathy, life after death, and ideas of a non-personal God.

It is worth noting that the participants in our sample are, on average, in their mid-forties. Data from a cross-sectional Portuguese population survey suggested that adherence to religion practices is greater for age groups older than 30 (Cabral, 2001). Additionally, the homogeneity of our sample is not only mirrored in the religious practices but also in the exposure to science: participants are highly involved in religious practices (e.g. frequent personal prayer) and moderately exposed to science (e.g. frequent visit to scientific spaces). While high involvement in religious practices is not surprising, exposure to science among religious education teachers is an extra-role activity and, thus, even if moderate, expresses an intentionality in being part of both worlds (religion and science). Such behaviour is coherent with religion teachers' views on the relationship between science and religion, as expressed in the survey.

As we had a proposition about the relation between variables (dependent and independent), regression analyses were performed. However, due to the correlational study design, it is not possible to fully claim directionality. For instance, the perception that thoughts about religion have been strengthened by science (item 2 from Measure 2) was predicted by exposure to scientific content. However, it could be the other way around (the perception leading to exposure to science instead) or a third variable not measured could have explained the

association. Only with an experiment or a longitudinal study would it be possible to establish causality in these terms. Nevertheless, the mere fact that associations were found is in itself quite meaningful as an operationalization of Barbour's (1990; 1997) typology. Indeed, independence can be inferred from a complete lack of association between science and religion (one has nothing to do with the other), conflict can be inferred from a negative association between them (the more one, the less the other) and integration can be inferred from a positive association (the more one, the more the other). Dialogue is more difficult to infer, possibly because there might be an underlying dimension of uncertainty in the role played by science and religion.

In Barbour's (1990, 1997) terms, conflict does not seem to be the main way they relate science and religion. This suggests that the views of Barbour's (1990, 1997) typology might be, indeed, useful to understand the way participants make sense of the relationship between science and religion. According to the results of the survey, the view of independence between science and religion does not seem to apply completely, because respondents considered that scientific discoveries and religious teachings are entirely compatible; claimed that scientific findings had strengthened what they think about religion, and science exposure was significantly correlated with this perception. In supporting the dialogue or the integration views, we can note, for example, that respondents claimed that catechism teachers should have more scientific training but also that believers should know more about science to sustain their faith and that scientific culture leads to maturity in faith and religious practice. If they are to starkly contrast religion with anything, it is magic and superstition. These results still open the room for further exploring which of the views (dialogue or integration) might be more appropriate to describe how these teachers relate science and religion.

The view of conflict (Barbour, 1990, 1997) is not completely ruled out because more than half of the participants either acknowledged conflict between teachings from science and religion or did not have a clear opinion on the matter (Measure 2, item 1, see Table 3). Considering that there is a general discrepancy between one's own perceptions of conflict between science and religion and (overestimated) perception of this conflict among others (Pew Research Center, 2015), we assume that this personal vs group discrepancy might have happened as well in this research. Indeed, teachers perceived themselves as different from other Catholics regarding the vision of the world (71% thought that many believers still have a vision of the world as if Galileo and Darwin had never existed). This might be analogous to a well-documented person vs group discrepancy in social psychology regarding the issue of social discrimination, when the targets of discrimination tend to perceive that their group is heavily discriminated but deny being discriminated themselves (Crosby, 1984; Taylor, Wright, Moghaddam, & Lalonde, 1990).

Comparing the perceptions of religious education teachers with those of students ([DFBR], 2016b; 2019), the differences are striking. Whereas the prevalent views among religious education teachers were dialogue and/or integration, the prevalent view among students was conflict ([DFBR], 2016b), even if the causes of conflict are not to be found in creationism or literal reading of the Bible. Nonetheless, if we consider solely the answers of Catholic students, differences become less visible. What becomes more informative is that while teachers seem to hold clear views of the relation between science and religion (representing it within a view of dialogue and/or integration), students – even the Roman Catholics, as shown by the quantity of answers around the midpoint of the scale – seem more puzzled with the topic in question ([DFBR], 2016b).

The keystone for achieving a balance between science and religion views seems to be the refusal to read the Bible literally, the item that received the strongest support. Considering that Bible is perceived as more literal for Protestants than for Roman-Catholics (Hoffman & Bartkowski. 2008), this result might signal the importance of approaching different religious denominations when addressing religious views, even within Christianity. In a Roman Catholic context, miracles, saints, and catechesis play an important role. In this sample, saints were valued for their example of life rather than for the miracles they performed. Furthermore, miracles were not perceived by all teachers as something extraordinary, unexplainable by science. The role of science in catechesis was also critically acknowledged. Interestingly, religious education teachers and Roman Catholic students expressed higher agreement with the idea that catechists should have more scientific training than non-believer students ([DFBR],2019). Some items regarding the lack of scientific explanation as an essential part of miracles, perceptions that religion has been adapting to science, and perceptions that many issues in typical catechesis disagree with the current scientific culture show dispersion in the distribution of scores. The meaning of this dispersion is disputable, but given the homogeneity of the sample, the variability might indicate that there is room within the Roman Catholic religion to hold different views.

It is not easy to find legitimate windows within the compartmentalized school time to introduce multidisciplinary reflection, but new opportunities might be devised in a recent Portuguese legal diploma. It tries to stimulate school's autonomy and curricular flexibility through a trade-off between the time dedicated to interdisciplinary projects and the specific disciplinary goals to fulfil ((Diário da República, 2018) in the Portuguese law)). With this new legislative landscape in the horizon, the results from this study gain more acuity, because they

inform us that religious education teachers do not perceive science and religion realms as conflicting (just independent, at most) and that their faith is not a threat to science teaching.

Limitations and suggestions for further studies

Keeping in mind that participants showed - for most topics/items - a lack of association between perceptions of science and religion, and exposure to science and/or religious practice, future studies could further examine whether this lack of association can be interpreted as an independence view on the relationship between science and religion. If the science-religion relationship found in religious education teachers in this study is one of independence, it can have negative implications for drawing the cross-disciplinary relationships much needed for enabling epistemic insight. Indeed, what Billingsley and Fraser (2018) consider a "siloed approach" towards teaching (p. 1109), with science and religion curricula being taught impermeably can be the result of an independence view of science and religion, and future studies should address whether this claim is plausible. The results from this and future studies could inform much needed discussions among teachers about the kind of training and activities that might help to promote the dialogue between science and other perspectives, such as the religious, in schools. For instance, almost half of the sample thinks that scientists should not be restrained by religious/moral concerns in their practise, but at the same time, they try to settle boundaries, as they do not think science will explain everything. One should not limit the ethical arena to science and religion because other social structures and forces (political, economic, legal) are at play. Nevertheless, the effective power of influence of religion in practical life is a complex issue (Pais, Cabral, & Vala, 2001) that would be worth discussing in classrooms in a holistic way, congregating science, religion, philosophy, history, and other relevant subjects.

Informed by religious teachers' perspectives from this study, they might be ready and perhaps willing to engage in conversation about the relationship between science and religion. Teachers could act as advocates for curricula allowing for that interdisciplinary conversation and could, as well, mediate such conversation.

Future empirical studies are needed to help assess to what extent, in what terms and with which effects, the dialogue between science and religion could effectively take place in schools. For example, it is urgent to collect data from natural/life science teachers to confront their views with those of religion education teachers and students. It is also urgent to develop better measures assessing Barbour's (1990; 1997) typology and to determine whether they are mutually exclusive. One hypothesis is that the perception of one's own relation with science and religion might be different from other people, even within the same ingroup.

The limitations of the current statistical analyses, being carried over items based on theoretical ideas on the relation between science and religion, such as those of Barbour (1990, 1997), stress the need for complementary qualitative in-depth studies. As claimed by Latour (2007), social scholars of science must follow the actors in their daily life settings in order to understand the way people make sense of the complexities of the world. In fact, the risk of reducing the views of the participants to standardized items is to ignore novelty and contradictions that do not fit in our theoretical models. Instead, if we decide to listen and follow actors - in the sense of actor-network theory (Latour, 2007) - wherever they take us, the chances of widening our perspectives over the subject of interest will increase greatly.

Our findings can also be complemented with much needed studies about - whether and if so - the way teachers promote interdisciplinary dialogue in their classes. Science teachers interact in class with many students who also attend religious education classes, and vice-versa; thus,

teaching that is not siloed would benefit all parts. Therefore, it is important to analyse how teachers perceive the relationship between science and religion. Such understanding is important to inform any educational planning in sciences and religion education, treating it as not an exclusive matter for science or religious education teachers, respectively.

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Table 1

Frequencies, descriptive statistics and prediction (by religion belief, religious practice and exposure to science) of relevant items of Measure 1 (Taber et al. 2011)

Items	1	2	3	4	5	*M*	*SD*	Prediction by religious belief	Prediction by religious practice	Prediction by exposure to science
1. I believe miracles can happen as religion describes.	9 (5%)	24 (12%)	38 (19%)	90 (46%)	35 (18%)	3.60	1.06	*	*n.s.*	*n.s.*
2.A good scientist CANNOT believe that the universe was created approximately 6000 years ago.	19 (10%)	47 (25%)	27 (15%)	38 (21%)	54 (29%)	3.33	1.39	*n.s.*	*n.s.*	*n.s.*
3.I believe that the universe was created in the way the Bible describes.	71 (36%)	65 (33%)	19 (10%)	30 (15%)	12 (6%)	2.22	1.25	*n.s.*	*n.s.*	*n.s.*
4.I accept the scientific theory that the whole universe was created in a big bang.	14 (7%)	26 (14%)	34 (18%)	80 (42%)	37 (19%)	3.52	1.16	*n.s.*	*n.s.*	*n.s.*
5.I think a lot about whether science and religion fit together.	9 (5%)	28 (15%)	20 (11%)	94 (50%)	37 (20%)	3.65	1.10	*n.s.*	*n.s.*	*n.s.*
6.I am confused about what to believe – we are told different things about how the universe and life began.	65 (34%)	88 (47%)	21 (11%)	11 (6%)	4 (2%)	1.95	0.94	*n.s.*	*n.s.*	*
7.Religious ideas about how the universe began have been PROVED WRONG by science.	59 (30%)	85 (43%)	27 (14%)	20 (10%)	5 (3%)	2.12	1.03	*	*n.s.*	*n.s.*
8.The scientific and the religious versions of how the universe began CANNOT both be true.	92 (48%)	76 (39%)	11 (6%)	11 (6%)	3 (2%)	1.95	0.94	*n.s.*	*n.s.*	*n.s.*

1 – I totally disagree; 2 – I disagree; 3 – I'm not sure; 4 – I agree; 5 - I totally agree

n.s. – not significant

* - significant at $p<.05$

Table 2

Descriptive statistics and prediction (by religious belief, religious practice and exposure to science) of Measure 2 (Longest & Smith, 2011)

Scale	*M*	*SD*	Difference in perception depending on religious belief	Prediction by religious practice	Prediction by exposure to science
Compatibility between science and religion	3.69	0.68	*n.s.*	*n.s.*	*n.s.*

n.s. – not significant

Table 3

Frequencies, descriptive statistics and prediction (by religion belief, religious practice and exposure to science) of Measure 2 items (Longest & Smith, 2011)

Items	1	2	3	4	5	*M*	*SD*	Prediction by religious belief	Prediction by religious practice	Prediction by exposure to science
1.The teachings from science and religion often conflict with each other	10 (6%)	55 (30%)	32 (18%)	74 (40%)	11 (6%)	3.12	1.08	*n.s.*	*n.s.*	*n.s.*
2.What I think about religion has been strengthened by some scientific findings	5 (3%)	7 (4%)	16 (9%)	109 (60%)	40 (22%)	3.97	0.86	*n.s.*	*n.s.*	*
3.Scientific discoveries and religious teachings are entirely compatible with each other	2 (1%)	19 (10%)	27 (15%)	90 (50%)	42 (23%)	3.84	0.94	*n.s.*	*n.s.*	*n.s.*
4.Scientists should be free to do any research, even on controversial matters like human cloning, without interference of religious teachings or moral rules	33 (18%)	71 (39%)	28 (15%)	33 (18%)	16 (8%)	2.60	1.23	*n.s.*	*n.s.*	*n.s.*

1 – I totally disagree; 2 – I disagree; 3 – I'm not sure; 4 – I agree; 5 - I totally agree

n.s. – not significant
* - significant at $p<.05$

Table 4

Frequencies, descriptive statistics and prediction (by religious belief, religious practice and exposure to science) of relevant items of Measure 3 ([DFBR], *2016b)*

Items	1	2	3	4	5	*M*	*SD*	Prediction by religious belief	Prediction by religious practice	Prediction by exposure to science
1.The theory of evolution can be accepted by believers	1 (1%)	3 (2%)	7 (4%)	84 (45%)	85 (47%)	4.38	3.69	**	*n.s.*	*
2.The Bible can NOT be read literally	2 (1%)	6 (3%)	1 (1%)	50 (28%)	122 (67%)	4.57	0.77	*n.s.*	*n.s.*	*n.s.*
3.Science has no explanation for some events – and it never will	11 (7%)	8 (5%)	8 (5%)	81 (48%)	57 (34%)	4.00	1.09	*n.s.*	*n.s.*	*n.s.*
4.The essential about miracles is their lack of scientific explanation	20 (12%)	64 (38%)	31 (19%)	36 (22%)	12 (7%)	2.73	1.16	*n.s.*	*n.s.*	*n.s.*
5.Both religion and science have a dynamic character	0	5 (3%)	6 (4%)	85 (49%)	77 (45%)	4.35	0.69	*n.s.*	*	*n.s.*
6.Saints are important because they are an example of life	0	2 (1%)	2 (1%)	57 (35%)	103 (63%)	4.59	0.58	*	*n.s.*	*n.s.*
7.Many believers still have a vision of the world as if Galileo and Darwin had never existed	10 (6%)	18 (10%)	22 (12%)	95 (54%)	30 (17%)	3.67	1.05	*n.s.*	*n.s.*	*n.s.*
8.Catechism teachers should have scientific training to sustain their logic	0	8 (5%)	8 (5%)	90 (51%)	70 (40%)	4.26	0.75	*n.s.*	*	*n.s.*
9.Many issues in typical catechesis disagree with the current scientific culture	4 (2%)	42 (23%)	37 (20%)	77 (43%)	21 (12%)	3.38	1.04	*n.s.*	*n.s.*	*n.s.*
10.Believers should know more about science so as to sustain reasons to have faith	4 (2%)	8 (4%)	9 (5%)	84 (46%)	76 (42%)	4.22	0.90	*n.s.*	**	*n.s.*

Items	1	2	3	4	5	*M*	*SD*	Prediction by religious belief	Prediction by religious practice	Prediction by exposure to science
11.A greater scientific culture might lead to a more mature religious practice	2 (1%)	6 (3%)	15 (8%)	82 (45%)	76 (42%)	4.24	0.83	*n.s.*	*n.s.*	*
12.Scientific culture contributes to a mature faith	1 (1%)	3 (2%)	5 (3%)	76 (48%)	73 (46%)	4.37	0.70	*n.s.*	*n.s.*	**
13.As science develops, religion loses importance	67 (38%)	81 (46%)	12 (7%)	12 (7%)	3 (2%)	1.87	0.93	*n.s.*	*n.s.*	*n.s.*
14.Religion has been adapting to science	15 (9%)	45 (26%)	38 (22%)	68 (39%)	7 (4%)	3.04	1.08	*n.s.*	*n.s.*	*n.s.*
15.Saints are important for the miracles they've done or do	12 (8%)	29 (18%)	24 (15%)	62 (39%)	34 (21%)	3.48	1.22	*n.s.*	*n.s.*	*n.s.*
16.Catechism is all about religion, therefore it has no need for scientific culture	72 (41%)	72 (41%)	11 (6%)	16 (9%)	3 (2%)	1.89	1.00	*n.s.*	*n.s.*	*n.s.*
17.Scientists tend not to have faith	36 (21%)	60 (35%)	42 (24%)	30 (17%)	5 (3%)	2.47	1.09	*n.s.*	*n.s.*	*n.s.*
18.God was invented by religion	114 (65%)	49 (28%)	7 (4%)	1 (1%)	2 (1%)	1.43	0.71	*n.s.*	*n.s.*	*n.s.*
19.Magic and superstition are part of religion	62 (39%)	59 (37%)	18 (11%)	13 (8%)	5 (3%)	1.98	1.07	*n.s.*	*	*

1 – I totally disagree; 2 – I disagree; 3 – I'm not sure; 4 – I agree; 5 - I totally agree

n.s. – not significant
* - significant at $p<.05$
** - significant at $p<.01$