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Russian Teacher's Conceptions of Evolution

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Abstract – **We present here the first data on the conceptions of evolution of teachers in Russia, collected in the State of Oryol (403 pre-service and in-service teachers, from primary and secondary schools). These conceptions vary according to the teachers' religion. They also vary with other parameters, such as gender and the level of teachers' qualifications, but with no interaction with effects of religious belonging. The 67 Agnostic or Atheist teachers in the sample were clearly Evolutionist, as were the 13 Muslim teachers, and half of the 280 Orthodox teachers. Only 7% to 20% (depending on the question) of the Orthodox teachers ticked the most creationist boxes and had, possibly, more problems than their colleagues in teaching evolution. They are the group whose belief in God is most pronounced, and who practice their religion most assiduously. They are the group whose belief in God is most pronounced, and who practice their religion most assiduously. They also display the most conservative socio-political opinions. We compared these results with those obtained in other countries, where teachers filled out the same questionnaire, which was developed and validated by the European research project, Biohead-Citizen.**

Keywords – **Evolution, Quantitative research, Science-Religion Relation / Interface, Creationism, Teachers.**

I. Introduction and Research Questions

Today, nothing in modern biology can be addressed without taking into account the evolutionary perspective [1]. Nevertheless, in some countries, political or religious leaders object to its teaching [2]. Indeed, the growth of the influence of fundamentalist groups has encouraged attempts to undermine the teaching of science by suggesting the introduction of creationist ideas in the *curricula*, and, in some cases, to prevent the teaching of evolution in schools.

Teachers are key actors in science education. In 18 countries, the Biohead-Citizen project (2004-2008) analysed teachers' ideas about and attitudes to evolution [3]-[5], and revealed highly contrasting conceptions depending on the country in question. These results also demonstrated an absence of religious influence in specific countries, with very few exceptions. For instance, in Lebanon, Sunni Muslim teachers tend to be more creationist than their non-Sunni colleagues, while in Burkina Faso, Muslim teachers are less creationist than their Christian colleagues [6], [7]. This research project was later extended to 12 other countries around the world, including nations in Europe (Denmark, Sweden, Spain and Serbia); in Africa (Cameroon, Gabon and South Africa); and in other regions (Australia, Georgia, Malaysia, South Korea and Brazil). This research reveals major differences in the 30 countries surveyed as well as the effect of religion in a few of them [8], [9]. For example, Evangelist Protestant teachers were more creationists in outlook than their colleagues in Brazil [10], in Malaysia [11], in South Korea [12], and in South Africa [13]. We present here another extension of this research, analysing teacher's conceptions of evolution in Russia.

The Russian Federation is, geographically speaking, the world's largest country. It has 143 million inhabitants. 76% of the population follow the tenets of the Russian Orthodox Church. Islam is the country's second largest religion (there are between 10 and 12 Muslims in the country). Secularism – or, to use the term coined by Baubérot [14], "laicity", from the French "laïcité" – is a legal requirement in public life in Russia. It does not mean the promotion of Atheism, but, rather, a tolerance of all religions. Russia is a very conservative country, marked by a political system in which Vladimir Putin has been President since 2000). Progressive ideas hold little sway in the country (since Czarist times, there has been no real debate on environmental issues and sustainable development, while gender equality is a distant goal. For example, homosexuality is often seen as a disease, and "Gay Pride" demonstrations always finish with violence clashes with local police).

We attempt here to answer three research questions:

1. Do Russian teachers' conceptions of evolution vary depending on their religion?
2. Do these conceptions vary depending on other controlled parameters, such as the teachers' gender, age, subject matter for which they are responsible, or level of qualifications?
3. And is the effect of religion still significant after the suppression of these other effects – gender, age, subject matter, and level of qualifications -, or is it a single consequence of one or several of these other effects?

II. Methods

The sample consists in 403 teachers in Oryol State, either teaching in primary or secondary schools, or finishing their teacher training. Oryol, which has over a million inhabitants, is located 400km south of Moscow in the European part of Russia. The city of Oryol has a population of 500,000. Consequently, this study cannot be generalised to the whole of Russia. However, while our results are not representative of the Russian Federation in its entirety, they do allow for comparisons with other parts of the country. Oryol was chosen because of a previous collaboration between the author's university and the Oryol State University of Education, which provided opportunities to collect data. Nevertheless, the state is indeed representative of Russia in that it is a mainly Orthodox Christian and rural state, whose economy is based on cereal farming in the countryside and metallurgy in Oryol City. Oryol State is markedly conservative; the Communist Party is very strong in local politics, and Putin is, locally, an uncontroversial, even beloved figure.

As in the other 30 territories studied using the Biohead-Citizen protocol, the study included six samples, designed to be the most representative of Russian teaching staff. One third teach in primary schools, and two thirds in secondary schools, teaching science (biology), or letters (in Russian,

the national language) to 11-18 year olds. Within each third, half the teachers are in-service, and the other half is completing their teacher training. The six samples are:

(1) InB: In-service teachers of Biology in Secondary Schools.
(2) InL: In-service teachers of Russian Language in Secondary Schools.
(3) InP: In-service teachers in Primary Schools.
(4) PreB: Pre-service teachers of Biology in Secondary Schools.
(5) PreL: Pre-service teachers of Russian Language in Secondary Schools.
(6) PreP: Pre-service teachers of Primary Schools.

Table 1 indicates the number of teachers who filled out the questionnaire for each of these six categories.

	InB	InL	InP	PreB	PreL	PreP
Number of Teachers	59	142	105	18	58	21
%	14,6	35,2	26,1	4,5	14,4	5,2

Table 1. Composition of the six samples.

Teachers completed a questionnaire developed and validated by the Biohead-Citizen project and presented in the project's final report [15]. Here, we primarily use the 15 questions about evolution, 6 of them opposing creationist and Evolutionist values, 2 relating to teleological evolution (Finalism), and the other 7 related to knowledge of the processes of evolution. We also use the 17 questions about personal information regarding individual teachers: gender, age, subject matter, level of qualifications, religion, degree of belief in God and the practice of a particular religion, and political and social opinions.

The teachers filled out the questionnaire in their school, or at the end of their courses at Oryol State University. In each case, participants remained anonymous. The data was then entered in an Excel file that was later analysed in France.

The statistical analysis was conducted by a statistician using the free software "R", primarily the "ADE 4" package (R Development Core Team, 2006). In order to answer research questions 1, 2 and 3, we used between-class analyses [16], [17] to discriminate between religions (Question 1) or between the other controlled parameters (Question 2). A Monte Carlo permutation test [18] was also used to gauge whether or not the difference between the groups was significant. This randomisation test randomly attributes a religion to each teacher. A thousand (1,000) permutations were effected and the differences between teachers in regard to their attitudes to religion were compared to the 1,000 differences obtained randomly. To answer Question 3, we used PCAOIV (Principal Component Analysis of the Orthogonal Instrumental Variables) [19], taking into account the 15 questions associated with evolution after suppressing the significant effects of controlled parameters other than religion. The objective here was to see whether the religion effect was still significant or was just one consequence of another significant effect.

III. Results

A. *The Effect of Religions*

To answer Research Question 1 on the religion effect, we first present Table 2, describing the religion declared by the teachers in the sample.

	AGN= Agnostic or Atheist	MUS = Muslim	ORT = Orthodox	NR = Don't want to answer
Number of teachers	67	13	280	43
%	16,6	3,2	69,5	10,7
% of teachers who ticked a religion	18,6	3,6	77,7	-

Table 2. Religion declared by teachers.

Only 43 teachers ticked the "I don't want to answer" box. 77.7% of the other teachers in the sample declared themselves Orthodox, a figure very similar to the percentage of Orthodox Christians in the Russian Federation as a whole (76%). Only 3.6% of the teachers in the sample declared that they were Muslim (as opposed to 7% in the country as a whole). The other 18.6% ticked the Agnostic or Atheist box. It can be observed that Oryol State generated percentages similar to those of the Russian Federation as a whole.

The between-class analysis highlights significant differences associated with the teachers' respective religions. Nearly 80% of the total variance is related to Component 1, which is the horizontal axis of Figures 1(b) and 1(c). Each point of Figure 1(b) represents a teacher's conceptions of evolution, and is related to the centre of gravity of his/her religion. Teachers' conceptions of evolution mainly differ among this horizontal axis: the most strongly evolutionist conceptions are located on the left, with the most creationist ones on the right (Figure 1(c)). Most of the creationist answers to Items B48, B28, A64 and A62 are located on the right. Conceptions relating to Finalism and to knowledge of the processes of evolution (the other items) have less weight on Axis 1. This axis opposes on the right (Creationist Pole) the Orthodox group, and on the left (Evolutionist Pole) the other groups, i.e. Agnostic/Atheist (AGN), Muslim (MUS), and those who did not want to declare a religion (NR).

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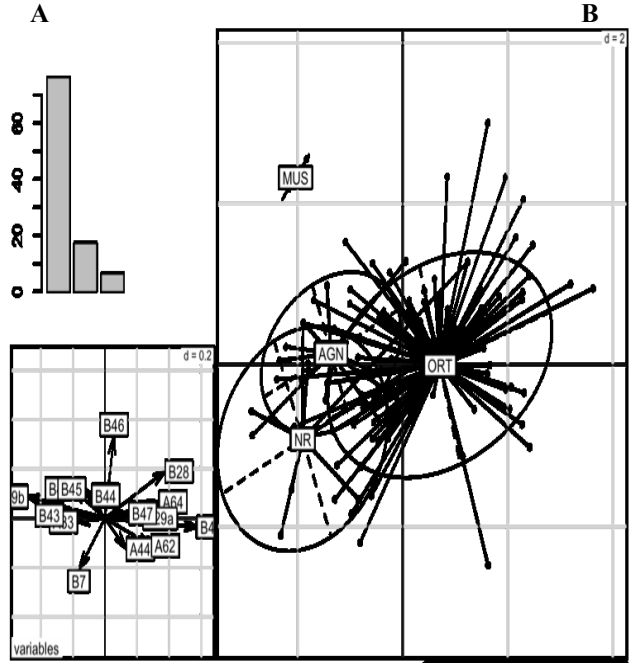

Fig. 1. Between-Class Analysis differentiating the groups of teachers defined by their declared religion (ORT = Orthodox, AGN = Agnostic or Atheist, MUS = Muslim, NR = I don't want to answer).

The answers to Questions A64 and B28 (Figures 2 & 3) are very similar; the first is related to the origin of life, the second to the origin of mankind. In both, there are four statements; the first two are clearly evolutionist (the first of these is more dogmatic than the second), while the fourth is clearly Creationist. The third statement is both Evolutionist and Creationist, accepting the natural processes of evolution, but considering that God governs them.

In regard to Question A64 (Figure 2), nearly all the Agnostic/Atheist and Muslim teachers ticked Boxes 1 or 2, while only 50% of Orthodox teachers ticked those boxes. Agnostic/Atheist and Muslim teachers provided clearly evolutionist answers, while 50% of Orthodox teachers provided creationist answers.

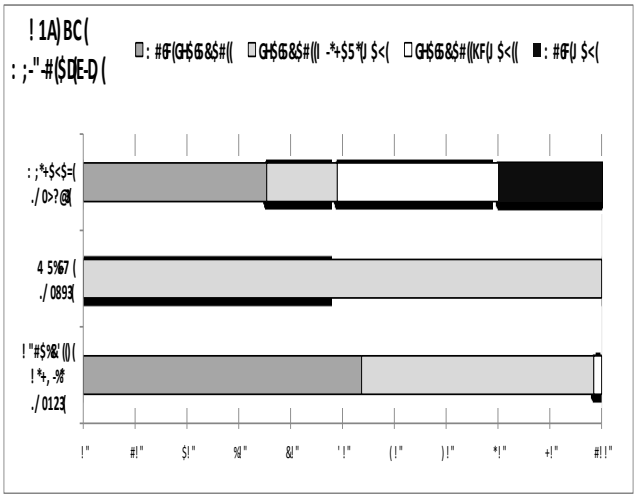

Fig. 2. Teachers' answers, grouped by their declared religion, to Question A64:

A64. Which of the following four statements do you agree with the most? (Tick only **ONE** answer)

- ☐ It is certain that the origin of life resulted from natural phenomena.
- ☐ The origin of life may be explained by natural phenomena without considering the hypothesis that God created life.
- ☐ The origin of life may be explained by natural phenomena that are governed by God.
- ☐ It is certain that God created life.

The same trends emerge from the answers to Question B28 on the origin of humanity. But in this instance, in the three groups who have declared a religion, a majority of teachers ticked Box 3 (Evolutionist and Creationist). Indeed, 12% of Agnostic/Atheist teachers ticked this box; for them, the origin of humanity is a little more mysterious than the origin of life. Half of the Orthodox teachers in the sample ticked a creationist proposition, whereas most Agnostic/Atheist teachers ticked an evolutionist proposition.

Question A62 (Figure 4) is also related to the origin of humanity, but this time in a different sense. Teachers are asked to tick three boxes concerning ideas relating to humankind's origins, among six phrases (three concerning Evolution, and three concerning Creationism). The answers clearly demonstrate the same trends as in Figure 3, with fewer than 20% of Agnostic/Atheist teachers ticking one or two Creations expressions, probably due to the fact that they recognise their cultural importance. It should be observed that none of the 13 Muslim teachers from the region ever ticked a Creationist box.

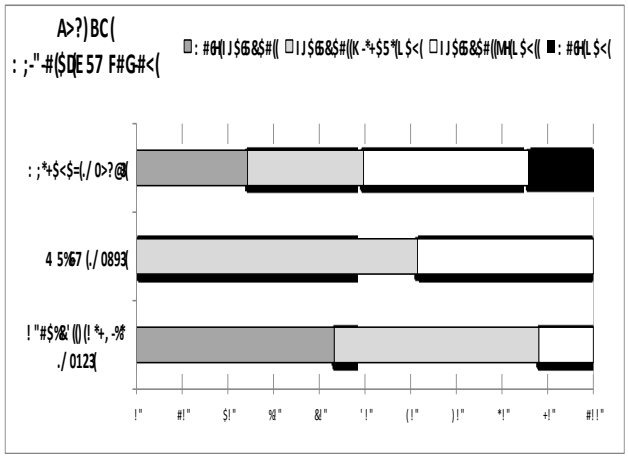

Fig. 3. Teachers answers, grouped by their declared religion, to Question B28:

B28. Which of the following four statements do you agree with most? Select **ONLY** one sentence:

- ☐ It is certain that the origin of humankind is to be found in evolutionary processes.
- ☐ Human origin can be explained by evolutionary processes without considering the hypothesis that God created humankind.
- ☐ Human origin can be explained by evolutionary processes that are governed by God.
- ☐ It is certain that God created humankind.

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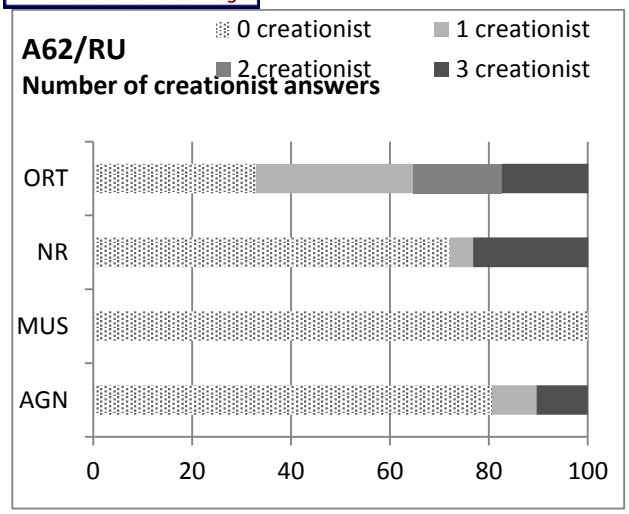

Fig. 4. Teachers' answers, grouped by their declared religion, to Question A62:

A62. In the list below, tick the THREE expressions that you think are the most strongly associated with the origins of humankind.

☐ Adam and Eve ☐ Australopithecus ☐ Creation
☐ Evolution ☐ God ☐ Selection

Seven questions (B42 to B48) concerned the processes of species evolution. One of these processes (B48) concerned the importance of God, and the answers (Figure 5) display the same trends as the three preceding questions; only 7% of Orthodox teachers ticked the "No importance at all" box, while 100% of the 13 Muslim teachers, and 78% of Agnostic/Atheist teachers ticked that box. It should be noted that 22% of those teachers (probably some of the Agnostic teachers) ticked "Great importance". Once again, we can underline the difference between Muslim and Orthodox teachers – the first accord no importance to the role of God in evolution, the second accord some importance.

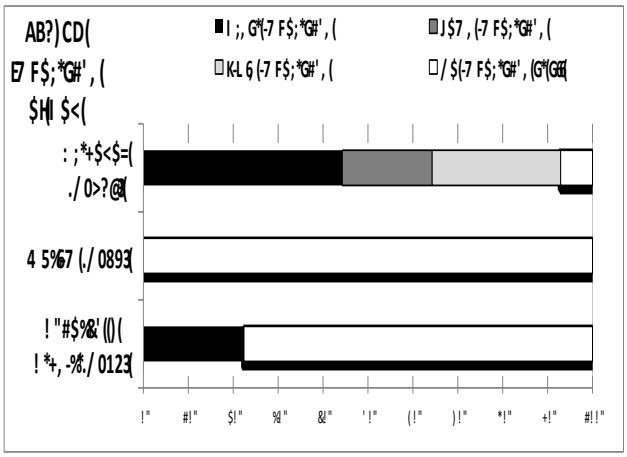

Fig. 5. Teachers' answers, grouped by their declared religion, to Question B48:

Indicate your evaluation of the importance of the following factors in species evolution (tick only **ONE** box for each line): **God**

The other questions related to processes of species evolution that had only a small impact on explanations of differences between declared religions (Figure 1(c)). Figure 6 illustrates answers about the importance of natural selection: all the Agnostic/Atheist, and all the Muslim teachers' ticked the "Great importance" box, as did 73% of Orthodox teachers. Nevertheless, 7% of Orthodox teachers ticked "No importance at all", while 20% ticked "Some importance".

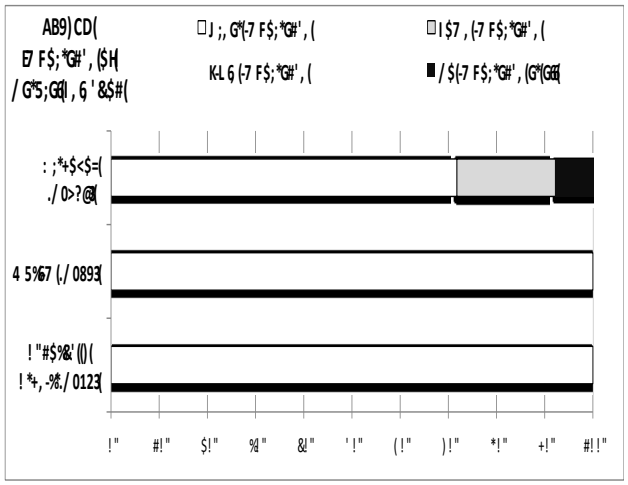

Fig. 6. Teachers' answers, grouped by their declared religion, to the question B43:

Indicate your evaluation of the importance of the following factors in species evolution (tick only **ONE** box for each line): **Natural Selection**

B. *Group, Gender Age and Education Effects*

The goal of research questions 2 and 3 is not to analyse these other effects – group, gender, age and education - but merely to identify them with a view to ascertaining whether or not the religion effect is partially or totally a consequence of these other effects.

We sampled six categories of Pre-Service and In-Service teachers (Table 1). A between-class analysis completed by a randomisation test revealed significant differences among the six groups, most of them relating to the different levels in the teachers' knowledge of the processes of evolution, as well as of questions relating to Finalism. Biology teachers (InB and PreB) are more familiar than their colleagues with the importance for evolution of processes like natural selection and chance. Over 80% of biology teachers totally disagree with the Finalist proposition (A44 "The emergence of the human species (*Homo sapiens*) was the aim of the evolution of living species"), while fewer than 40% of their colleagues did. Moreover, some language teachers ticked the radical creationist proposition for the origin of humankind (25% of InL and 7% of PreL), and for the origin of life (respectively 20% and 35%), while none of the biology teachers or primary school teachers in our sample ticked that box.

85.1% of the total sample was made up of female teachers. Indeed, the gender effect was significant, particularly in terms of a number of questions relating to knowledge and Finalism. For example, not a single man in

the sample (as opposed to 39% of women) entirely agreed with the proposition: "The emergence of the human species (*Homo sapiens*) was just as improbable as the emergence of any other species" (Question A33).

The effect of the age of members of the sample was also significant in terms of questions relating to knowledge of the processes of species evolution, and, in particular, to the two questions (A33 and A44) relating to Finalism (teleological evolution associated with the emergence of mankind). For instance, teachers of between 35 and 40 years old disagreed more than their colleagues with the Finalist proposition (A33).

Another significant effect is associated with the "level of teachers' qualifications" (the number of years they have attended university). This effect is also linked to questions of knowledge, as well as to creationist conceptions (origin of humanity, origin of life). For instance, in answering Question A62 (including a number of creationist expressions, see Figure 4), 40% of teachers who had attended university for three years selected three creationist expressions. This figure was 3% for teachers who had attended university for one or two years, and 10% for teachers who had spent four or more years at university.

All these effects are potentially linked. For example, taking into account the fact that a majority of Orthodox teachers spent three years at university, it is possible that their creationist ideas are more closely linked to their time in tertiary education than to their religion. Reciprocally, if the teachers who trained at university for three years are more Orthodox than their colleagues, this effect of the length of their training can be seen as a variable.

To answer this question, we conducted a PCAOIV, analysing whether the differences between the three religions declared by the teachers were still significant after the suppression of the other significant effects: the six samples (Table 2), gender, age and the number of years spent at university during their training. The result of this analysis, completed by a randomisation test (Monte Carlo) shows that the difference between declared religions is still clearly significant ($p<0.0001$). This conclusion is mainly derived from the answers to the same questions already identified from Figure 1: the origin of life (A64, Figure 2), the origin of humanity (B28, Figure 3 and A62, Figure 4), B48 (Figure 5) and also – even though this factor has less impact – the importance of natural selection (B43, Figure 6).

In conclusion, the effect of the teachers' religion is not a unique consequence of an unequal distribution of the other significant parameters within the three religions. We also demonstrated that two of the other effects (gender and level of qualifications) are still significant after the suppression of the other significant effects (including religion). Those effects will be analysed in future articles.

IV. Discussion

A. *Muslim and Orthodox Teachers*

The study is the first analysis based on Russian teachers' conceptions of evolution. It reveals significant differences in attitudes associated with the declared religions of the teachers in the sample.

Not surprisingly, as in other countries in which the same research was carried out [20], [21], all the Agnostic/Atheist teachers were clearly evolutionist. Nevertheless, in regard to the origin of humanity, 12% of them are both Evolutionist and creationist, ticking Box 3 of Question B28 (Figure 3). The same teachers also ticked three creationist expressions associated with the origin of humanity (Question A62, Figure 4) and a little more (22%) gave great importance to the role of God in the evolution of species (Question B48, Figure 5). Memories of this minority of teachers are probably Agnostic, finding their place among the 67 Agnostic/Atheist teachers. For them, the mystery of the origin of humanity or of the evolution of species evolution can be linked to God.

The answers provided by the 13 Muslim teachers were all clearly Evolutionist, as were the conceptions of their Agnostic or Atheist colleagues. This is a very interesting result, in that most of the Muslim teachers who answered this questionnaire in other countries were clearly creationist, especially those in Algeria, Tunisia, Morocco, Senegal and Lebanon [22]. Even in France and Scandinavia, where the same small number of Muslim teachers (11 and 13, respectively) filled out the questionnaire, about one third of them were radical creationists, while the other third displayed both evolutionist and creationist attitudes. In order to ascertain whether or not this interesting result applies to other Muslim teachers, we will enlarge our inquiry to a Russian region with a larger Muslim population. Nevertheless, it should be noted that our result is coherent with the percentage of the population holding evolutionist views in Kazakhstan, a former Soviet republic, where only 28% of the people believe that evolution is false [23]. The results display even more pronounced Evolutionist attitudes in the 13 Russian Muslim teachers in our sample; perhaps this is because Russian teachers are more evolutionist than the Muslim Russian population at large, or because Muslim Russians have more evolutionist attitudes than Muslims in other countries. We will soon find a solution to this problem by means of new complementary data.

Nevertheless, 77.7% of our sample was made up of Orthodox teachers. Our results show pronounced differences in their conceptions. As shown in Figure 1b, about half of those displayed mainly evolutionist attitudes, while the other half revealed preponderantly creationist views. Figures 2 and 3 show that about 50% of them are clearly evolutionist in terms of their attitudes to the origin of life, and that 14% of them are evolutionist in regard to the origin of humanity (Figure 3). Finally, compared to Orthodox teachers who filled out the same questionnaire in other countries [24]-[26]. Russian Orthodox teachers are clearly more evolutionist in outlook than those in Lebanon, Georgia, Romania, and Cyprus, but a little less so than those in Serbia [27]. This confirms the importance of the socio-cultural context of individual countries. Although these teachers all belong to the Orthodox faith, their conceptions of evolution vary widely from one country to another.

We also carried out a Co-Inertia Analysis [28] in order to compare two PCAs (Principal Component Analyses)

obtained from two sets of questions, one relating to evolution, and the other to personal, political, and religious opinions. This analysis revealed that the Orthodox teachers with the most clearly creationist views are those whose belief in God is strongest, who practice their religion most assiduously, and who have the most conservative socio-political opinions. They tend to be against the separation of politics and religion, and of science and religion. Furthermore, they tend to be more in favour of private rather than public structures (health, pensions, schools), to be against immigration, and to question the use of government funds to provide poor people with health services. This may appear paradoxical in light of the message of love and solidarity delivered by the Orthodox religion, but it is coherent with the right-leaning political position of most Christian parties in Europe.

B. *Educational Implications*

Our study enables us to discuss a number of educational implications. Over a third of the teachers interviewed (half of them Orthodox teachers) agreed with creationist conceptions of evolution. We therefore recommend the introduction of an epistemological component into teacher training and a historical approach to science in the training curriculum, including a particular reference to the topics referred to above (the origins of life and of humanity). This would undoubtedly boost the ability of students to develop a critical outlook in regard to new discoveries and ongoing debate in the field. An example of the success of this approach is provided by Tunisia, where most teachers are Muslim and creationist [29], [30].

Another recommendation would be to develop a critical analysis of school textbooks in Russia similar to those elaborated in other countries [31], [32] with a view to identifying implicit values and to suggest new ways of teaching evolution – particularly the origins of life and humanity – in a scientific manner. For example, images associated with the first *Homo sapiens* often feature only men (rather than women), and, indeed, exclusively white Western men [33], [34].

At a national level (or a regional level if the syllabuses and textbooks are regional in scope), we suggest the publication of critiques of textbooks in order to help teachers and schools in their choice of teaching materials.

Our main recommendation, even more important than the preceding ones, is to trigger a debate on how to encourage governments to introduce more education on evolution in their respective education systems. The gradual implementation of Environmental Education (EE) could serve as an example. What kind of equivalent of the Tbilissi International Conference on Environmental Education (1977) can be considered? What kind of activities (associations, museums, science centres, media, books and journals for children, literature, games, etc.) can be developed to make people more familiar with knowledge concerning biological evolution? This kind of international survey could also be extended to an analysis of students' conceptions of evolution at various levels of the curriculum. International surveys, such as PISA and TIMMS, focus on knowledge and skills, forgetting values of citizenship, the inculcation of which is one of the fundamental objectives of education. Scientific knowledge about evolution is a value that cannot be rejected by education systems. Our results show that evolutionist conceptions can be compatible with a belief in God; biologists share evolutionist and creationist convictions more frequently than other teachers. Debate about the articulation of these two attitudes could be introduced into teacher training curricula.

V. Conclusion

One of the most important results of international comparisons carried out up until now is the importance of improving the level of teacher training. The higher the level (in any subject), the more teachers tend to hold evolutionist views [35]. Our findings partially confirm this result: teachers with the highest level of education tend to be more evolutionist in outlook than their colleagues who have spent three years or less training to be teachers at university. Education at school is key to promoting (or failing to promote) scientific ideas in society, and is a central explanatory factor in their potential articulation with religious convictions (when they are not too fundamentalist!).

We can also conclude on an optimistic note. Two thirds of the 403 Russian teachers who filled out our questionnaire in Oryol clearly hold evolutionist ideas, and, consequently, have no problem in teaching evolution. Moreover, in regard to the other third of the sample (half the Orthodox teachers), several are both evolutionist and creationist, and, consequently, also have also no problems in teaching evolution. In his well-known paper, "Nothing in biology makes sense except in the light of evolution", Dobzhansky wrote (p. 127), "I am a creationist and an evolutionist. Evolution is God's, or Nature's, method of Creation" [36]. Fewer than 20% of the 280 Orthodox teachers in our sample are more radically creationist in outlook, and may, therefore, have more difficulties in teaching evolution. However, 93% of them ticked the boxes indicated that natural selection played either a major or minor role in explaining the evolution of species.

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References

[1] T. Dobzhansky (1973), Nothing in biology makes sense except in the light of evolution, 35, pp. 125-129.

[2] IAP, InterAcademy Panel (2006), *IAP Statement on the Teaching of Evolution*.
Available: http: //www.interacademies.net/File.aspx?id=615

[3] P. Clément (2008), Human Evolution: Objectives, methodologies,

main achievements and implications. In Carvalho, G., Clément, P., Bogner, F. and Caravita, S. (Eds.), *BIOHEAD-Citizen: Biology, Health and Environmental Education for better Citizenship, Final Report* (pp. 54-67). Brussels: FP6, Priority 7, Project N° CITC-CT-2004-506015.

[3] P. Clément, P., & M. P. Quessada (2008), Creationist and/or evolutionist Beliefs of Biology Teachers: a comparative Research in 19 countries. *Natures Sciences Sociétés, 16*, pp. 54-158.

[4] P. Clément, & M. P. Quessada (2009), Creationist Beliefs in Europe. *Science, 324(26)*, pp. 16-44.

[5] P. Clément & M. P. Quessada, M. P. (2012), Conceptions on Evolution from Christian teachers from 16 different countries. *Proceedings from 7èmes Rencontres de l'ARDIST, Les Cahiers d'Esquisse, 5*, pp. 95-104.

[6] P. Clément (2015), Muslim teachers' conceptions of evolution in several countries. *Public Understanding of Science, 24(4)*, pp. 400-421.

[7] P. Clément, P. (2014), Teachers' creationist conceptions in 30 countries. Do they vary according to their religion? *Éducation & Sociétés, 33(1)*, pp. 113-136.

[8] P. Clément, (2015), Creationism, Science and Religion: A Survey of Teachers' Conceptions in 30 countries. *Procedia - Social and Behavioral Sciences*, 167, pp. 279–287.

[9] P. Clément, (2015), Creationism, Science and Religion: A Survey of Teachers' Conceptions in 30 countries. *Procedia - Social and Behavioral Sciences*, 167, pp. 279–287.

[10] M. Chan Kit Yok, P. Clément, L. Kim Leong, C. Lee Shing, C. & P. Anak Ragem (2015), Preliminary Results on Malaysian Teachers Conception of Evolution. *Procedia - Social and Behavioral Sciences, 167*, pp. 250–255.

[11] H. A. Seo, & P. Clément (2015), Teachers' views on evolution: religion matters in South Korea. *Procedia - Social and Behavioral Sciences, 167*, pp. 96-102.

[12] M. Stears, P. Clément, P, A. James & E. Dempster (2016), How does religion influence South African teachers' conceptions of evolution? *South African Journal of Science*, *112(5-6)*, pp. 23-33.

[13] J. Baubérot, J. (2010), Secularities in the world. Paris: Presses Universitaires de France.

[14] G. Carvalho, P. Clément, P., F. Bogner & S. Caravita (2008), *BIOHEAD-Citizen: Biology, Health and Environmental Education for better Citizenship, Final Report*. Brussels: FP6, Priority 7, Project N° CITC-CT-2004-506015.

[15] S. Dolédec & D. Chessel (1989), Seasonal Rhythms and stationary Components in the aquatic Environment. *Acta OEcologica, OEcologia Generalis, 10*, pp.207–232.

[16] F. Munoz, F. Bogner, P. Clément & G. Carvalho (2009), Teachers' conceptions of nature and environment in 16 countries. *Journal of Environmental Psychology, 29*, pp. 407-413.

[17] C. Romesburg (1985), Exploring, confirming, and randomization tests. *Computers & Geosciences*, *11(1)*, pp. 19-37.

[18] R. Sabatier, J. D. Lebreton & D. Chessel (1989), Principal component analysis with instrumental variables as a tool for modeling composition data. In Renato Coppi and Silvano Bolasco (Eds.), *Multiway data analysis* (pp. 341-352). North-Holland: Elsevier Science Publishers B.V.

[19] P. Clément (2014), Teachers' creationist conceptions in 30 countries. Do they vary according to their religion? *Éducation & Sociétés, 33(1)*, pp. 113-136.

[20] P. Clément (2015), Creationism, Science and Religion: A Survey of Teachers' Conceptions in 30 countries. *Procedia - Social and Behavioral Sciences*, 167, pp. 279–287.

[21] S. Hameed (2008), Bracing for Islamic Creationism (from the data published by Hassan, 2007). Science, 322, pp. 1637-1638.

[22] P. Clément & M. P. Quessada (2013, August), Conceptions of Primary and Secondary Teachers from 28 countries on biological Evolution vary according to their Country and their Level of Training]. AREF's *Proceedings,* Montpellier, France. http://hal.archives-ouvertes.fr/hal-01026095

[23] P. Clément (2014), Teachers' creationist conceptions in 30 countries. Do they vary according to their religion? *Éducation & Sociétés, 33(1)*, pp. 113-136.

[24] P. Clément (2015), Muslim teachers' conceptions of evolution in several countries. *Public Understanding of Science, 24(4)*, pp. 400-421.

[25] P. Clément (2015), Creationism, Science and Religion: A Survey of Teachers' Conceptions in 30 countries. *Procedia - Social and Behavioral Sciences*, 167, pp. 279–287.

[26] J. Stanisavljević, D. Đurić, L. Stanisavljević & P. Clément (2015), Analysis of pre-service and in-service views of evolution of Serbian teachers. *Archives of Biological Sciences*, *67*, pp. 317-329.

[27] S. Dray, D. Chessel & J. Thioulouse (2003), Co-inertia analysis and the linking of the ecological data tables. *Ecology, 84(11)*, pp. 3078–3089.

[28] S. Aroua, M. Coquidé & S. Abbès (2005), Epistemological reflexions and the scientific status of biological evolution: case of a teaching content in Tunisia]. *Proceedings from Quatrièmes Rencontres Scientifiques de L'ARDIST*, pp. 25-32. Lyon: INRP.

[29] S. Aroua, M. Coquidé & S. Abbès (2009), Overcoming the effect of the socio-cultural context: Impact of teaching evolution in Tunisia. *Evolution: Education and Outreach-2(3)*, pp. 474–478.

[30] P. Clément (2008), Relating to critical analysis of school science textbooks. *Science Education International, 19(2)*, pp. 93-96. http://www.icaseonline.net/sei/june2008/19-2-june-2008-93-96.pdf

[31] M. P. Quessada, P. Clément, B. Oerke & A. Valente (2008), Human evolution in science textbooks from twelve different countries. *Science Education International*, *19(2),* pp. 147-162. http://www.icaseonline.net/sei/june2008/19-2-june-2008-147_162.pdf

[32] M. P. Quessada & P. Clément (2007), An epistemological approach to French curricula on human origin during the 19th & 20th centuries. *Science & Education, 16(9-10)*, pp. 991-1006.

[33] M. P. Quessada, P. Clément, B. Oerke & A. Valente (2008), Human evolution in science textbooks from twelve different countries. *Science Education International*, *19(2),* pp. 147-162. http://www.icaseonline.net/sei/june2008/19-2-june-2008-147_162.pdf

[34] P. Clément & M. P. Quessada (2014), Conceptions on Evolution from Christian teachers from 16 different countries. Proceedings form *7èmes Rencontres de l'ARDIST, Les Cahiers d'Esquisse, 5*, pp. 95-104.

[35] T. Dobzhansky (1973), Nothing in biology makes sense except in the light of evolution, 35, pp. 125-129.

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Frédéric CHARLES

Frédéric Charles was born in France in 1973. He studied biology at the University of Reims Champagne-Ardenne and completed a Master's degree at this University. His Ph.D. thesis that he defended at La Sorbonne (University of Paris Descartes) was about the first science and technology education in primary school.

He was associate in Biology Education at the University of Reims Champagne-Ardenne (France) and trained biology teachers for 14 years (1999-2012).

Dr. Charles is lecturer at University Claude Bernard Lyon 1 since 2013. He teaches at the High School of Education and does his research at the S2HEP laboratory. This research focuses on teachers' professional skills and biology content teaching and learning as metamorphosis, evolution and scientific classification.

Pierre CLÉMENT

Pierre Clément is now retired, but is still active in research. Starting in Animal Biology (first prize of the French Society of Zoology in 1979), he then developed teaching and research in Biology Education, co-creating in 1986 a Master and a Laboratory of Science Education (University Lyon 1). He was President of AEDB (Association Européenne de Didactique de la Biologie: 1989-1996). In 1996, he co-created ERIDOB (European Research in Didactics of Biology) and, in 1998, ARDIST (Association pour la Recherche en Didactique des Sciences et des Techniques). Since 2006, he is in the board of IOSTE (International Organization for Science and Technology Education).

He directed several national or international projects of research; the last one was BIOHEAD-Citizen (Biology, Health and Environmental Education for better Citizenship, 2004-2008; 19 countries). He is now extending this international research to other countries (presently a total of 34).

Dr. Clément taught and did his research mainly in the University Claude Bernard Lyon 1, but also in several other Universities in France, Europe, Africa and Lebanon. He directed 26 PhD theses, published > 150 articles in peer-reviewed Journals, > 250 Chapters of books or Proceedings. He is today attached to Aix-Marseille University at the ADEF laboratory.