

# QUANTITATIVE STUDY OF LOWER-SECONDARY SCHOOL STUDENTS' ACCEPTANCE OF EVOLUTION IN FRANCE

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# QUANTITATIVE STUDY OF LOWER-SECONDARY SCHOOL STUDENTS' ACCEPTANCE OF EVOLUTION IN FRANCE

*The present work aims to identify some factors that might influence lower secondary school students' acceptance of evolution in France, with a focus on religion. A closed questionnaire was designed based on previous research documenting students' conceptions of evolution, as well as existing concept inventories targeting older students. About 1600 students (aged 11 to 15) took part in the study. Quantitative analyses using multivariate analyses was conducted. Results highlight that more than a third of the students surveyed rejected the evolution of living species, regardless of the species considered in the question (humans, animals) and regardless of the class level (grade 6 to grade 9). Their declared religious beliefs strongly influenced their degree of acceptance, expressed in a school context in France.*

*Keywords*: Misconceptions, Quantitative methods, Secondary School

## INTRODUCTION

Evolution is a complex object of teaching and learning, with existing societal controversies (Williams, 2015) standing as obstacles to its acceptance. Students already have ideas about evolution that might be distant or even explicitly rejecting scientific explanations of evolution. A number of studies identify difficulties related to students believes influenced by cultural or sociocultural factors (see for example Hanley, Bennet & Ratcliffe, 2014). In France, evolution is taught from primary school in a context where secularity is one of the key pillars of the educational system (MENESR, 2016). However, Author (2011) has previously highlighted that French students can express non-evolutionist and fixist ideas at the end of primary school, predominantly for those receiving religious education at home (Author, 2011): children agree with a possible transformation of species but reject a common origin. In high school, the study of Fortin (2010) shows that students acknowledge the existence of a past world (mammoths or dinosaurs) and possible extinctions. However, their ideas are ranging from pro-evolutionist ideas, where students express ideas in line with scientific knowledge, to creationist ideas where students reject the idea of evolution. High school students often hold an anthropo-centered vision of evolution that hinders their acceptance of evolution.

Taking into consideration that the expression of religious beliefs is kept out of French schools and that French teachers, compared to other countries, largely accept the theory of evolution (Clément, 2015), the aim of this research is to identify to what extent French lower secondary school students (11-15 years old) are influenced by factors from their private sphere, and in particular the religion factor.

## METHOD

A quantitative approach was chosen to study the acceptance and knowledge of lower secondary school students. Such choice was made on the bases of the qualitative studies already conducted in France that document various conceptions held by French students regarding the theory of evolution (for example: Author, 2011; Fortin, 2010). From these conceptions, as well as existing conceptual inventories (Anderson, Fisher et Norman, 2002; Rutledge & Sadler, 2007; Yates et Marek, 2015), we developed a questionnaire that we called UnRESt (Understanding Randomness and Evolution for Students). UnRESt has a broader objective, to explore the link between how students understand evolution and how they understand randomness. The full questionnaire is composed of 64 closed questions and 3 sections: A) testing students'

acceptance and understanding of evolution, B) testing students' understanding of randomness and C) personal questions. In this communication, we focus on the results from section A, crossed with the expression of students' religious belief (section C). The questions in section A are statements where students are asked to position their agreement/disagreement on a 4 points Likert scale. Different dimensions of the theory of evolution were tested by the items, such as the apparition, extinction, common origin of animals, etc (Author, 2018). Three items per dimension are present, with same wordings, but different examples for humans, living and extinct animals.

UnRESt was filled by 1,634 students aged 11 to 15 from 10 different lower secondary schools in France. The sample is composed of a heterogeneous public according to different school characteristics: its location (urban or rural), the socio-economic background of the school (low, middle, high) and the type of school (public, private). All students in a same class responded, during class hour, with their teacher (mostly biology teacher).

Various methods were used to analyse the data: descriptive statistics to expose general tendencies on the degree of acceptance of the 1,634 students, followed by several multivariable analyses. In particular, in order to highlight the possible difference between the groups (age, class, degree of religious believes, etc) and its significance, we carried out a between-class analysis along with Monte Carlo Randomisation tests.

## RESULTS

The results of multivariate analyses show that the influence of religious beliefs (degrees of belief and practice) is greater than all the other variables tested in our study. The students who declare that they have religious beliefs and regular practice their religion are mostly accepting a divine origin of species and reject a common origin of species and the idea that living species evolve, and vice versa.

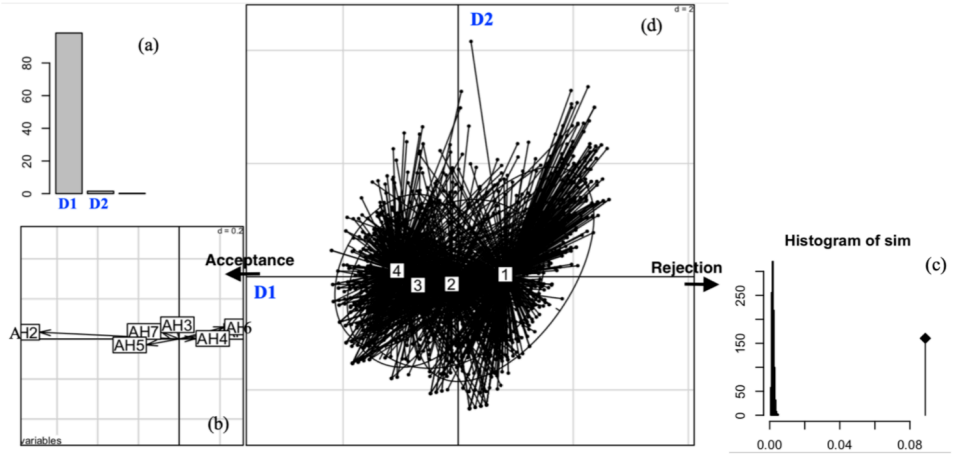



Figure 1. Between-class analyses of questions related to human evolution, depending on students declared degree of religious belief. (a) Histogram of eigenvalues of the axes D1, D2 and D3 (b) Correlation circles (c) Monte Carlo randomisation test (d) Distribution of the groups of students depending on their degree of religious belief (1 for strong belief, 4 for no or little belief declared)

In order to provide an insight of the analyses done, we present here the results of one between-class analyses focusing on the questions related to the context of human evolution (fig. 1). The D1 axis contains almost all (98%) of the information. The other axes (D2 and D3) form background noise because of their low variance (fig. 1a). Figure 1d represents the distribution of students according to their degree of belief. It highlights a clear difference between students on the D1 axis. The numbers, from 1 to 4, represent the four centres of gravities of the answers regrouping the students, 1 expressing stronger belief, 4 little or no religious belief.

Answers from students expressing stronger religious beliefs are at the highest of the positive values, and vice versa. The Monte Carlo randomization test indicates that the difference observed in figure 1d is strongly significant (p-value <0.001). The meaning of the D1 axis can be derived from the circle of correlations (fig. 1b). Three variables are more significant (according to the coordinates of these variables on D1) and are related to the statements expressing the degree of agreement/disagreement with a divine origin of humans (statement AH2) or common with other species (statement AH1) and expressing the possible evolution of human species (statement AH6). The other variables do not provide information that can be analysed. It appears that statement AH2 is negatively correlated to AH1 and AH6. Globally, when students from group 1 express agreement with a divine origin of humans (AH2), they reject the two other statements: common origin of humans (AH2) and evolution of humans (AH6), and vice versa. In particular, statement AH2 "Men were created by God" differentiates significantly students according to their religious belief (p-value <2.2e-16, Chi2 test).

## CONCLUSION

To conclude, more than a third of the students surveyed rejected the evolution of living species, regardless of the species considered (humans, animals) and regardless of the class level (grade 6 to grade 9). Their religious beliefs strongly influence their degree of acceptance, expressed in a school context in France. Such result was surprising considering the French context marked by a strict separation of religious practice and beliefs and formal school education. Also, previous research showed that France was part of countries with particularly few teachers (less than 2%) holding creationist conceptions (Clément, 2015). However, the cross-study in Belgium and Greece conducted by Wolfs (2013) highlight results that, even in a secular school context, and with non-creationist teachers, the teaching of evolution at school does not allow students to access non-creationist ideas. Our results come in line with others, stressing that personal ideologies tend to take over knowledge learned in formal school teaching (Drummond & Fischhoff, 2017). Perspective for this work is to explore alternatives to teach evolution, targeting the concept of randomness, also controversial when it comes to personal beliefs, in a context of a board game.

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