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## TEACHERS' CONCEPTIONS ON ENVIRONMENT AND GMO IN TWELVE EUROPEAN COUNTRIES

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## ABSTRACT

We analyze the conceptions of 4248 teachers on Environment and GMO (Genetically Modified Organisms), in 12 European countries: Cyprus, Estonia, Finland, France, Germany, Hungary, Italy, Lithuania, Malta, Poland, Portugal, Romania.

Most of the differences between teachers' conceptions are observed inside each country. Some of them (related to preservation or utilization of Environment) significantly differentiate the 12 countries. Biology teachers have more knowledge on GMO and more opinions pro-GMO than their colleagues. Female teachers are significantly more anti-GMO than their male colleagues. More a teacher studied at University, more he or she thinks that the resources of our planet are limited.

**Keywords:** *Environmental Education, GMO, teachers, conceptions, values, Europe.*

## INTRODUCTION

The acceptance or reject of GMO (Genetically Modified Organisms) is a controversial issue in the European Community, with an opposition of divergent scientific arguments generally linked to different opinions (Berlan & Lewontin 1986, Kempf 2003, Bonneuil *et al.* 2008). These opinions are often rooted in philosophical points of view on Nature and on Environment, associated with divergent values (Schultz & Zelezny 1999, Clément 2004a, 2004b). In a broader way, the importance of values in science education is re-emerging (Corringan, Dillon & Gunstone 2007), and values are not exactly the same among the European countries (Galland & Lemel 2007). According to European Commission public opinion survey (Eurobarometer, 2008), the majority of Europeans are opposed to the use of GMOs (58%). At the country level the resistance is more important in some countries as Cyprus (82%) than in other ones as Malta (28%) or Portugal (28%).

What are the teachers' conceptions related to GMO in different European countries? Are their conceptions linked to their philosophy and attitudes on Nature and Environment? Are they linked to their scientific knowledge, or mainly to their values? Are there differences among countries, or among other teachers' characteristics (as their age, gender, level of instruction)?

## METHODS

Twelve European countries were chosen from their diversity, from North to South and East to West of Europe, from diverse economical levels and cultures, including differences among their religions: Cyprus, Estonia, Finland, France, Germany, Hungary, Italy, Lithuania, Malta, Poland, Portugal, Romania. In each country, six samples of about 50 teachers filled out a questionnaire: in-service teachers in primary schools (InP), in-service teachers in secondary schools teaching biology (InB) or language (InL); pre-service teachers for primary schools (PreP), pre-service teachers for secondary schools in biology (PreB) or language / letters (PreL); for a total of 4248 teachers in the 12 countries.

Each teacher filled out a questionnaire built by a collective work of the European research project Biohead-Citizen (Biology, Health and Environmental Education for better Citizenship, 2004-2008). Our theoretical basis and our methodology are described in other works (Caravita *et al.*, 2008; Clément & Carvalho, 2007). We used several precautions: a pilot test, interviews, avoiding bias in translation, etc. The final questionnaire (144 questions) included 29 questions related to Environment, 5 of them dealing with GMO. The teachers' answers were discussed using multivariate analyses (Munoz *et al.*, 2009): mainly PCA and between analyses completed by randomization tests (Monte Carlo type).

## RESULTS

\* The PCA (Principal Components Analysis) shows the main oppositions among the 4248 teachers' conceptions: the first one between the poles preservation and utilization of environment, with some link between preservation and anti-GMO opinions, and between utilization and pro-GMO opinions. The second opposition is related to the "feelings" of animals: being ecolocentric (pole preservation) or anthropocentric (pole utilization), a teacher can think that snails, flies and frogs are or not able to feel happiness. The third principal component is mainly defined by the 5 questions related to GMO, with a clear opposition between the pole anti-GMO and the pole pro-GMO.

\* A between analyses shows that the teachers' conceptions differ very significantly ( $p < 0.001$ ) among the 12 European countries, mainly from the questions related to preservation or utilization of Environment. For instance, more than 80% of teachers are, in Lithuania, confident with the society to solve even the biggest environmental problems, while this percentage is about 1/3 in Finland and Poland, but less than 10% in the other countries.

\* An other between analysis shows that biology teachers (InB and PreB) have more scientific knowledge on GMO than their colleagues, and are also more pro-GMO.

\* An other between analysis shows a significant gender effect, men being a little more pro-GMO than their female colleagues.

\* We also found a significant effect of the teachers' level of qualification: more a teacher studied in University more he or she disagrees with the proposition "Our planet has unlimited natural resources".

## CONCLUSIONS

The controversial issue of GMO is only partly linked to other conceptions on Environment, and has some specificity. The differences among the countries are mainly related to teachers' values, their philosophy of Nature, utilization or preservation of Environment. The opposition between pro- and anti-GMO are found inside each country, with some significant correlations with the teachers' gender, their level of qualification, and the difference between the biology teachers and their colleagues. Finally, the teachers' opinions on GMO are less linked to their knowledge on the possible danger of GMO for environment than to a reject of too much biotechnology, as already suggested by de Chevigné (2004).

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