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## **Constructing and validating a questionnaire for an international comparative analysis of teachers' conceptions of biology, health and environment: the European project of research Biohead-Citizen.**

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### **Abstract**

This workshop intends to discuss how a large international questionnaire should be constructed to be applied in several countries with different cultural background and languages. We will present and discuss the methodology used in our European research project Biohead-Citizen to analyse the conceptions of in-service and pre-service teachers in 18 countries concerning biological, health and environmental issues. We will work on some specific examples coming from this project.

The several steps of the questionnaire construction – which will be the bases for the discussion in the workshop – are the following:

- A clear definition of the goals of the research and of the theoretical background.
- Gathering questions (in English) related to the goals, either tested in prior research or entirely new. Collective discussion on these questions.
- Questionnaire translation (from English) in each country and, very important, validation of the translations, using procedures that we will present and test during the workshop.
- Teachers' interviews to identify difficulties related to particular questions.
- Questionnaire pilot test to analyse the reliability of each question (two tests on the same sample groups a month apart).
- Application of statistical methods (MCA and PCA) for the selection of the most discriminating questions and the most pertinent ways to analyse data.
- Improvement of the initial questionnaire to prepare the final questionnaire.
- Definition of the sample groups and delineation of the precise context and way to apply the questionnaire.
- Finally, gathering all the data and their analysis: Some of them will be used and discussed. Each step will be a matter of discussion to raise awareness of the difficulties in this process and to find out alternatives also reliable for the construction and application of a questionnaire to a variety of cultural contexts.

### **Key-words**

Multiculturalism – Questionnaire construction – Translation procedures – Reliability – Pilot test - Multivariate analysis

## **SYNOPSIS**

To build a questionnaire, to test it and to validate it, are not easy steps. The complexity is greater when the same questionnaire is constructed and applied to different countries with diverse cultural backgrounds. This workshop is dealing with these difficulties, using data and results from our European project of research Biohead-Citizen (Biology, Health and Environmental Education for better Citizenship). We present here the successive steps of this project of research: some of them will be collectively worked during the workshop, using precise examples and data.

### **The first step: definition of the goals of the research and of the theoretical background.**

The definition of the research goals and the theoretical background were carried out at the project preparation (Carvalho, Clément & Bogner, 2004).

The goal is to analyse the conceptions of teachers on topics related to biology, health and environment, and to the difficulties to teach them. The theoretical background is the KVP Model, where conceptions are analysed as interactions between scientific knowledge (K), systems of values (V) and social practices (P) (Clément 2004, 2006, Clément & Carvalho in this Conference). Specific topics corresponding to controversial issues, where the interactions between these 3 poles KVP are maximal, were identified.

We also decided to work on contrasted countries, with precise hypotheses for their choice: 6 countries outside Europe to evaluate a possible homogeneity of conceptions inside the different European countries, and 13 European countries to identify possible difference between more or less developed ones, Northern or Latin countries, East and West Europe, catholic, protestant, orthodox and Muslim traditions, etc.

At the beginning of the project we reduce the field to six specific topics: (1) Environmental Education and Ecology, (2) Health Education, (3) Human reproduction and sexuality, (4) Evolution, mainly human origins, (5) Human genetics, (6) Human brain and its epigenesis.

### **The second step: gathering questions tested in precedent research.**

The 3 fields (biology, health and environmental education) had been already worked by the 3 coordinators of the project and their teams, for instance, Environment in Germany and in France, with a comparison between France, Germany and Portugal. Health education and sex education had been the speciality of Carvalho and the other topics more linked to biology were worked by Clément and his team (and also with non European countries, now associated in the Biohead-Citizen project). All these works used questionnaires, and we selected the most related ones to our project. We also used some questions coming from other works of research, and some new questions built collectively during the 6 first months of the project (e.g. questions on Environment coming from Italy and Estonia).

From this collective work emerged our first questionnaire divided in 5 parts: T (transversal, with 84 questions dealing with biology, health and environment), E (environment: 38 questions), H (health: 35 questions), B (biology: 26 questions) and P (19 personal questions: gender, age, matter, diploma, religion, political position). Each question was discussed collectively to be sure that it was meaningful (and in the same way) into the 19 countries of the project. This was difficult but exciting due to the cultural diversity of the countries.

### **The third step: translation of the questionnaires, and validation of the translations.**

Specific methods were used: (1) two parallel independent translations in the national language from the original English, then comparison by a third person, (2) translation and then back-translation in English and comparison with the original English.

More precise procedure was used to define from the English questionnaire two other reference questionnaires, one in French and one in Arabic. From this work, some ambiguities were found in the formulation of few questions, therefore the corresponding changes were

done in the English initial questionnaire as well as in the Arabic and French questionnaires. The translations in the other languages was carried out from English and/or French questionnaires of reference.

### **Interviews to identify difficulties related to some questions.**

Each team interviewed some persons after they had filled in the questionnaire, to identify the most problematic questions, and to suppress or to change them in the final questionnaire. The problems came from either the translation either the questions themselves.

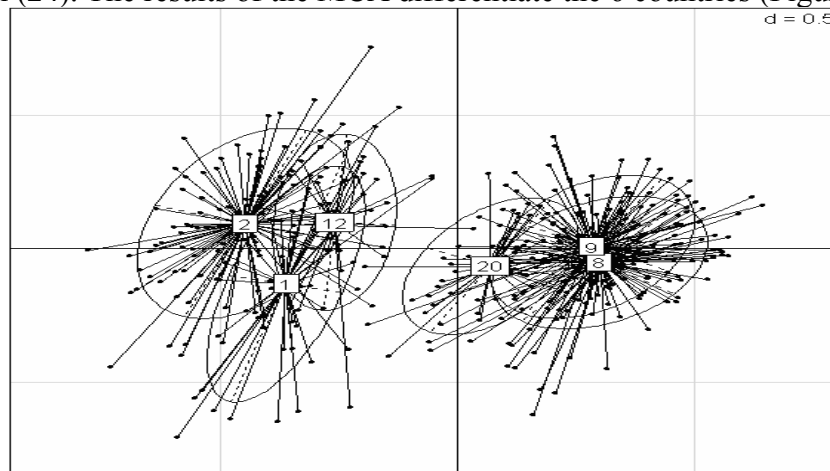
### **Analyse of the reliability of each question**

The same questionnaire was proposed twice to the same students, with more than one month between the two tests. This was done in 4 countries. The questions with a low rate of reliability of answers by the same responder were suppressed. It was the case of all open questions, and of some other ones.

### **Using a pilot test to select the most discriminative questions, and the most pertinent ways to analyse data.**

This was done with limited samples of students (or pre-service) teachers from 13 countries. The personal questions were filled in all the countries, but were not used for the MCA (Multiple Components Analysis). They were only used in a second step to interpret the results of the MCA.

**(1) In six countries**, the four parts of the questionnaire were submitted: T, E, H, B. The total sample is 411 students: Portugal (42), France (100), Hungary (24), Lebanon (113), Tunisia (108), Senegal (24). The results of the MCA differentiate the 6 countries (Figure 1).



**Figure 1: Representations of MCA individuals, grouped by country (plane F1-F2).**

1:Portugal; 2:France; 8:Lebanon; 9:Tunisia; 12:Hungaria; 20:Senegal.

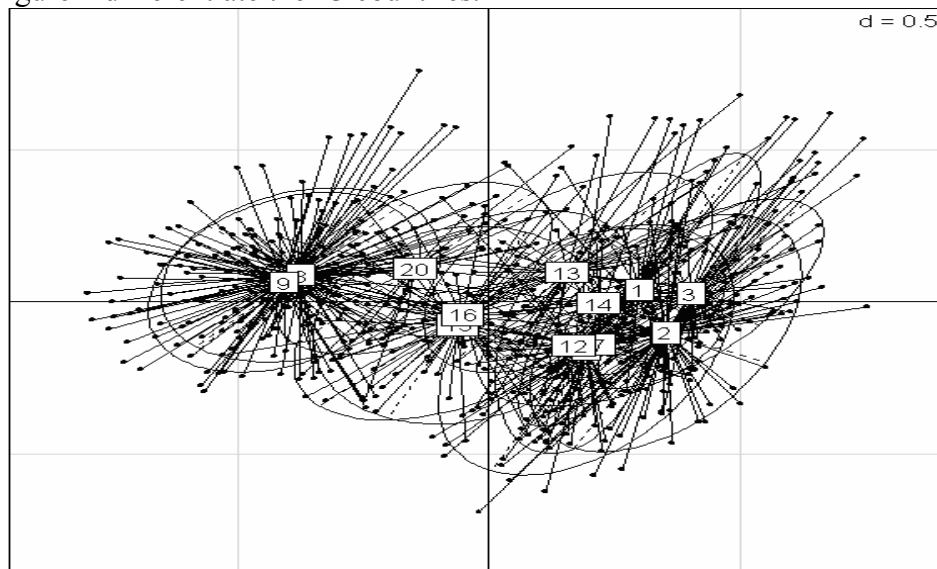
In figure 1, each point represents a student, each ellipse is surrounding 2/3 of the students from the same country (identified by a number in the centre of the ellipse). The horizontal axis F1 is the most important one. Its meaning is given by the place, along it, of the modalities of answers to several questions (not drawn in the figure 1):

- Evolutionist answers are at F1 left side and creationist answers at F1 right side.
- Higher sexual freedom are at F1 left side, and their opposite at F1 right side.
- At F1 left side there is more reaction to protect the Environment than at right side.

The strong opposition in the conceptions of European and non-European pre-service teachers can be linked to some of the controlled personal variables, the most important of them being the belief in God (nearly all the responders believe in God in the countries at right of the F1

axis; in contrast with the atheist and agnostic responders at the left of the F1 axis). Muslims are mostly at right, but Christians are located all along the F1 axis.

(2) *The second MCA is dealing with 13 countries*, from only two questionnaires: T, E. The total sample is 654 students: the same as in the precedent sample plus Germany (49), Italy (40), Estonia (21), Lithuania (44), Malta (17), Poland (32) and Romania (40). The results of MCA in Figure 2 differentiate the 13 countries.



**Figure 1: Representations of MCA individuals, grouped by country (F1-F2).** 1:Portugal; 2:France; 3:Germany; 5:Italy; 7:Estonia; 8:Lebanon; 9:Tunisie; 12:Hungaria; 13:Lithuania; 14:Malta; 15:Poland; 16:Romania; 20:Senegal. Italy (5) & Estonia (7) are underneath Hungary (12); Poland (15) under Romania (16).

This MCA results are quite similar to the precedent one (with just an inversion of the F1 axis: what was at left is here at right and vice-versa). The meaning of the axis F1 is the same. The new information is the position of some countries (Poland and Romania) in the middle between the European countries (at right) and the non European ones (at left).

### **Consequences on the construction of the final questionnaire.**

Being the initial questionnaire was too long in the pilot test, the final questionnaire had to be reduced in half approximately. We suppressed the questions where everybody answered more or less in the same way in the pilot tests (this information is acquired: no need to test them again) as well as all the non reliable questions. We maintained the questions that were discriminative and meaningful (in relation to our precise hypotheses) in the multivariate analyses done (MCA: figure 1 & 2, but also PCA and others). We also defined precise samples (of in-service and pre-service teachers) and the contexts and ways to ask them to fill the questionnaires (the same process in each country).

We have now all the data from the new questionnaires, and we have started to analyse them. We will give more details, and the state of our research, in the workshop. ***However our main goal is to propose activities and promote a debate about the methodology for a questionnaire construction (and its application) by researchers of diverse cultural contexts.***

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