Epistemological beliefs of European physiotherapists – a multi-country cross-cultural adaptation for the DEBQ and the CAEB questionnaires

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ABSTRACT
This article assumes that epistemological beliefs of physiotherapists are an important determinant in improving the concept of evidence-based practice. Little research has been done on epistemological beliefs in physiotherapy. In order to measure the sophistication of epistemological beliefs in future research, two complementary questionnaires (DEBQ and CAEB) were cross-culturally adapted in nine different countries and seven languages in Europe. A standardized seven-step guideline was used to translate and culturally validate the questionnaires. The questionnaires were distributed in the respective countries, resulting in 1386 participants. The psychometric values were analysed in order to verify consistency and validity. Based on the validation process, the instruments are considered to be validly adapted for the countries involved. The uniformity in the adaptation process allows for future comparison of the countries.

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Introduction
This study is performing a multi-country cross-cultural adaptation of two complementary questionnaires within the domain of physiotherapy. The domain-specific Epistemological Belief Questionnaire (DEBQ) and the Connotative-Aspects of Epistemological Beliefs (CAEB) can measure, from different perspectives, the domain-specific epistemological beliefs of physiotherapy. This research seeks to answer the following research question: can the DEBQ and the CAEB questionnaires be cross-culturally adapted for different countries within Europe, while keeping the uniformity needed in order to be comparable?

The adapted questionnaires can be used in future research to measure and compare the epistemological beliefs of physiotherapists in various countries in Europe. This introduction first describes the context of this study and then the background of the cross-cultural adaptation.

Context
In physiotherapy one of the main demands is to work within the framework of evidence-based practice.[1] This is a challenge, as the practitioner needs to constantly negotiate both the individual context of the patient as well as the fast growing amount of external evidence. The evidence-based practice (EBP) movement is facing a number of challenges.[2–6] These challenges are: the suboptimal or even damaging care given to patients,[3] the failure to get new knowledge to professionals,[6] and the growing expenses.[4] This makes a reorientation of the underlying concepts of the EBP movement necessary. The understanding of knowledge is one of the more fundamental but little researched underlying concepts.[7]

The individual thinking of the physiotherapists, and how they develop their expertise, is based on how they define, individually or within the professional community, what relevant knowledge is, and how they access this knowledge.

Knowledge could be considered to be certain and be transferred from an authority to the professional. In this case the main challenge would be how to select the right information and how to transfer it (guidelines, education etc.) to the professional. An opposing view would be to consider knowledge as less certain, changeable and depending on the context and the persons involved. From this perspective, selecting and transferring knowledge would become insufficient, because there is the likelihood of not taking the specifics of the context into consideration. The understanding of the local context and of how other people think would then...
become increasingly important. Because meaning can differ between persons and can be more or less explicit, communicating and sharing this specificity becomes a key factor.[8] When evidence-based practice was adopted in physiotherapy, little attention was given to the importance of the way knowledge was viewed.[3]

This study aims to contribute to a better understanding of the way physiotherapists view the nature of knowledge, which is a matter that concerns the field of personal epistemology.[9] This research area focuses on what individuals believe about, what counts as knowledge and where it resides, how individuals come to know, and how knowledge is constructed and evaluated.[10] This is called epistemological beliefs. These beliefs can be divided into general beliefs and domain-specific beliefs. In this study, the interest is in the specific beliefs of the domain of physiotherapy.[11] Epistemological beliefs influence how an individual physiotherapist in daily practice resolves competing knowledge claims, evaluates new information and makes decisions.[12] When put on a continuum, it shows on one side naïve beliefs based on the unequivocal and objective nature of knowledge coming from authoritative sources; on the opposite side, a sophisticated perception in which the nature of knowledge is contextual, temporary and coming from a variety of sources.

There are several instruments to measure domain-specific epistemological beliefs.[9] The choice for the questionnaires used has been made because they allow for the gathering of data from a large population with a low financial and time investment. They also allow for an attainable comparison between the respondents.

The choice for the following questionnaires – Domain specific Epistemological Belief Questionnaire (DEBQ) and Connotative-Aspects of Epistemological Beliefs (CAEB) – has been made based on their complementary perspective in terms of measuring the sophistication of the epistemological beliefs. Both questionnaires recognize different dimensions (or factors) in their construct. These factors specify the content and construct, and thus the validity of the instruments.

The DEBQ is based on the assumption that people can make their beliefs explicit. Hofer and Pintrich[9] suggest that the individual beliefs about knowledge and knowing are organized in personal epistemological theories. This offers a way to conceptualize a discipline-specific understanding of epistemology.[9,13,14] This has relevance, as it seems that epistemological assumptions of individuals are grounded in disciplinary contexts. This personal epistemology can also differ in a person when regarding different disciplines.[9] This epistemological theory recognizes five dimensions that group together in the two areas of epistemology: the nature of knowledge and the process of knowing.[13] (Table 1).

Most research share the view that epistemological knowledge consists of declarative beliefs that can be articulated by the individual. This view is challenged by another viewpoint, which asserts that many beliefs are implicit and so less articulated.

Stahl and Bromme[15] introduced the distinction in the interpretation of knowledge between explicit-denotative knowledge and associative-evaluative assumptions. Explicit-denotative knowledge refers to the more distal concept of knowledge for practice, which is relatively prescriptive, such as guidelines in physiotherapy or epistemological beliefs about science. The associative-evaluative assumption refers to a more proximal concept of knowledge of practice, being more personal, emotional and context dependent.[16] Stahl and Bromme[15] developed a new instrument, the CAEB, to measure these more connotative aspects. Connotative meanings evoke associative and evaluative judgments. The term comes from linguistics where it refers to additional and individual meanings that a person associates with a concept/word. Two dimensions were developed (Table 2).

The CAEB has also shown, besides a reliable measurement of the connotative aspects of epistemological beliefs, the way to predict how people critically evaluate (scientific) information.[17,18] This competence is a critical part of evidence-based practice.

In Europe, given the great diversity of cultures, it is interesting to see whether epistemological beliefs are similar between areas. The confirmation of this would set the stage for a further international development of the framework of evidence-based practice.

DEBQ has its origin in the USA; CAEB in Germany. To be able to use the source questionnaires across other countries in Europe, they need to be translated linguistically as well as adapted culturally through a semantic validation to ensure that the source text and the translation are equal. Beaton et al.[19] use the term “cross-cultural adaptation” to emphasize that the adaptation is focused on both language (translation) and culture in the process of preparing a questionnaire.

| Table 1. Dimensions of knowledge sophistication. |
|-----------------------------------------------|
| **Nature of knowledge**                        |
| Certainty                                      |
| Simplicity of knowledge                        |
| Process of knowing                             |
| Source of knowledge                            |
| Justification of knowledge                     |
| Attainment of truth                            |
| **Certainty**                                  |
| At lower levels, absolute truth exists with certainty. At higher levels, knowledge is tentative and evolving. On the lower level, knowledge is seen as discrete, concrete, knowable facts; at higher levels individuals see knowledge as more relative, contingent, and contextual. |
| **Simplicity of knowledge**                     |
| **Process of knowing**                         |
| **Source of knowledge**                        |
| **Justification of knowledge**                  |
| **Attainment of truth**                        |
| The extent to which experts can attain deep knowledge (i.e., “truth”) within their area of expertise. A high level of sophistication would put knowledge more in perspective. |

| Table 2. Dimension connotative meanings.      |
|-----------------------------------------------|
| **Texture**                                   |
| Beliefs about the structure and accuracy of knowledge. This dimension ranges from beliefs that knowledge is exact and structured to beliefs that it is unstructured and vague. |
| **Variability**                               |
| Beliefs about the stability and dynamics of knowledge. This dimension ranges from beliefs that knowledge is dynamic and flexible to beliefs that it is stable and inflexible. |

Copied with acknowledgement from the author: Hofer.[13]

Copied with acknowledgement from the author: Stahl and Bromme.[15]
to be used in another setting then where it was developed, and maintain the content validity of the instruments across the different cultures.[19]

To keep the ambition attainable, we selected nine countries from the European community of physiotherapy, each representing the northern, central and southern parts of Europe. The questionnaires were translated and culturally adapted for Finland, Denmark, The Netherlands, Italy, Spain and Portugal, and for the German speaking countries Austria, Switzerland and Germany. The created surveys needed to be cross-culturally adapted and also (stay) comparable to each other for further research.

**Methods**

The methodology for the adaptation was based on the guidelines of Beaton et al. [19] and Isis Innovation.[20]

**Description of the selected instruments**

Both instruments are self-reported online questionnaires. The DEBQ uses a 5-points Likert scale; ranging from “strongly disagree” to “strongly agree”. The CAEB uses a semantic-differential scale with opposite adjectives, with a 7-point Likert scale.[15] The proposed factors were used (Tables 3 and 4).

**Sample size and characteristics**

Each of these countries had the following contributors: an in-country investigator, two translators, one or two back translators and a group of five physiotherapy students. The in-country investigators were all senior lecturers in physiotherapy and teaching methodology. All translators were bilingual and either psychologists and physiotherapists. Back translators were all bilingual with the source language as their mother tongue. For the German language countries (Germany, Austria and Switzerland), a single validation process was performed with a multi-country group of collaborators, to maximize the equivalence between the questionnaire and the original source, while still ensuring each country-specific culture.

**Procedures**

Permission to carry out the translation and validation of the instrument was requested from the authors of the original questionnaires.

| Table 4. CAEB – Connotative Aspects of Epistemological Beliefs. |
|---------------------------------------------------------------|
| Items | Factors Stahl | Factors Hofer |
|-------|---------------|---------------|
| 1. Stable–Instable | Variability | Cert. |
| 2. Objective–Subjective | Texture | Cert. |
| 3. Confirmable–Unconfirmable | Texture | Source |
| 4. Dynamic–Static | Texture | Source |
| 5. Superficial–Profound | Texture | Cert. |
| 6. Temporary–Everlasting | Variability | Cert. |
| 7. Exact–Vague | Texture | Cert. |
| 8. Absolute–Relative | Texture | Cert. |
| 9. Sorted–Unsorted | Variability | Cert. |
| 10. Precise–Imprecise | Texture | Cert. |
| 11. Flexible–Inflexible | Variability | Cert. |
| 12. Definite–Ambiguous | Texture | Cert. |
| 13. Negotiated–Discovered | Texture | Cert. |
| 14. Structured–Unstructured | Texture | Cert. |
| 15. Completed–Uncompleted | Variability | Cert. |
| 16. Refutable–Irrefutable | Variability | Cert. |
| 17. Open–Closed | Variability | Cert. |

Copied with acknowledgement from the author: Stahl and Bromme.[15]
The project leader instructed the in-country investigator in the adaptation process, which was structured in seven phases, conforming to the guidelines of Isis Innovation. Each phase was supported with blue print forms to ensure attainability and uniformity:

- Forward translation
- Forward translation reconciliation
- Back translation
- Back translation review
- Pilot testing
- Pilot testing review
- Proofreading Forward

The review phases after the translation and the pilot allowed for a dialogue within the team and, in case of differences, the best translation, considering both linguistics and semantics, was chosen. The project leader ensured harmonization between in-country investigators during the process. The project leader made the survey for both the pilot phase and the final version available in the online environment (Google Forms, www.google.com/drive).

The in-country investigators were selected from members of the European Network of Physiotherapy in Higher Education. They were also asked to distribute the survey in their respective countries. The final versions of both questionnaires, as distributed per country, are available in the following supplementary material:

- Danish version of the DEBQ and the CAEB
- Finnish version of the DEBQ and the CAEB
- German version of the DEBQ and the CAEB
- Italian version of the DEBQ and the CAEB
- Dutch version of the DEBQ and the CAEB
- Portuguese version of the DEBQ and the CAEB
- Spanish version of the DEBQ and the CAEB

**Distribution of the survey**

The survey was distributed to the population of physiotherapists and physiotherapy students of each country in order to verify its psychometric qualities. The main distribution strategy was to use the academic network within the country.

The final version of the survey was distributed in seven languages and in nine countries between March and December 2015. For this study, we considered a minimum of 100 responses, from the countries where the survey was distributed, to be included for the psychometric analysis.

The statistical analyses for checking the psychometric value of the survey were therefore done for Dutch (N = 283), Portuguese (N = 277), Italian (N = 218), Danish (N = 151) Spanish (N = 229), Finnish (N = 105) and the German-speaking countries (N = 123), with in total 1386 respondents.

**Data analysis**

The data recorded on the Excel databases (per country) were exported to a single database created on the IBM® SPSS® version 22 (Armonk, NY). The internal consistency was assessed using Cronbach’s alpha coefficient, where a value between .70 and .95 is considered acceptable and indicates a high reliability.

In order to confirm the construct validity for the DEBQ and CAEB, a Confirmatory Factor Analysis was performed with the factors suggested in the original studies. Based on the rule that the initial Eigen values should be >1, in all countries a minimum of the proposed factors were recognized, allowing for a factor analysis. A principal component analysis (with varimax rotation) was performed for both questionnaires.

According to Hair et al. the Measure of Sample Adequacy (MSA), when reporting appropriateness of data for a factor analysis, is satisfactory with values >80. If the MSA was lower, we turned to Bartlett’s Test of Sphericity, and when this had an associated p value of <.001, we could continue to perform a valid factor analysis. Solutions were confirmed by successively omitting items with no substantial factor loadings (<.32). Items were also omitted with high loadings (>-.40) on more than one factor.

**Results**

The DEBQ was cross-culturally adapted for all nine countries. The CAEB was translated and validated for six countries, with the exception of Germany, Austria and Switzerland, since the original version was German. The investigator confirmed, with experts from the three German-speaking countries, the validity of the used linguistics for the cultures of Switzerland and Austria. For the other countries, the English translation of the CAEB was used, which was translated and published by the same research group.

**Results analysis of psychometric factors**

The MSA was confirmed for the seven languages, as the values were acceptable in combination with Bartlett’s test (Table 5).

The Eigen values were sufficient for performing a factor analysis for both questionnaires (Table 6).

**DEBQ**

The overall result from the DEBQ showed a consistent result with a Cronbach alpha with omitted items between .70 and .77 in the countries. For all countries, the four factors from the original article were reproduced; however, the loading of

| Countries     | DEBQ MSA plus Bartlett | CAEB MSA plus Bartlett |
|---------------|------------------------|------------------------|
| The Netherlands | .751–.000              | .798–.000              |
| Portugal      | .753–.000              | .905–.000              |
| Denmark       | .715–.000              | .805–.000              |
| Italy         | .739–.000              | .822–.000              |
| Spain         | .767–.000              | .840–.000              |
| Finland       | .634–.000              | .802–.000              |
| German SC     | .651–.000              | .786–.000              |
the items did not occur consistently compared with the original study and between the countries. The Cronbach alphas from the factor Certainty/Simplicity show an equal or higher number (between .67 and .79) compared to .66 in the original study. For the other three factors, the Cronbach alpha was low for all countries (Table 7).

CAEB

The Cronbach alpha from the CAEB shows satisfactory to good internal consistency (between .70 and .92). Items, when accepted, showed a 100% consistency based on which factor they load between countries. Items 1 and 15 loaded consistently on the texture factor, while, according to the original study, in terms of content they belonged to the variability factor. Item 4 also loaded consistently opposite as suggested in the original study, but in terms of the variability factor. The factor variability in the Finnish questionnaire lacks consistency (Table 8).

Correlation between the questionnaires

The instruments showed some convergent validity in negative low correlations found between the DEBQ certainty/simplicity factor and the CAEB texture factor. Given the opposite direction in scoring the items of the CAEB texture factor, this negative correlation could be expected. Between the DEBQ certainty/simplicity factor and the CAEB variability factor, a weak correlation was only found for the Netherlands (.134, \( p = .026 \)) and for the total (.130, \( p = .000 \)) (Table 9).

Discussion

The discussion begins by addressing the general process and the limitations of the parallel adaptation of the two questionnaires, followed by the psychometric analysis.

Adaptation process

The adaptation process followed the guidelines from Isis Innovation.[20] For practical reasons the guidelines’ recommendation to conduct two back translations with bilingual professionals was not followed. Instead, one translation per country was performed, and the country collaborators

Table 6. Total variance explained.

| Country | Factor 1 | Factor 2 | Factor 3 | Factor 4 |
|---------|----------|----------|----------|----------|
| NL | 3.78 | 13.88 | 2.07 | 7.65 |
| PT | 3.82 | 14.13 | 2.26 | 8.39 |
| DK | 3.58 | 13.25 | 2.90 | 10.74 |
| IT | 2.99 | 11.06 | 2.95 | 10.93 |
| ES | 3.91 | 14.50 | 2.87 | 10.62 |
| FI | 3.82 | 14.16 | 2.93 | 10.84 |
| GSC | 2.88 | 10.68 | 2.61 | 9.68 |

Table 7. DEBQ – Cronbach alpha factor analysis.

| Country | Total | Omitted items | Factor certainty/simplicity | Factor attainment of truth | Factor source | Factor justification |
|---------|-------|---------------|-----------------------------|----------------------------|---------------|----------------------|
| NL | .750 | .736 (25) | .769 | .567 | .541 | .268 |
| PT | .740 | .746 (24) | .779 | .601 | .507 | – |
| DK | .754 | .738 (23) | .759 | .621 | .479 | .615 |
| IT | .793 | .749 (21) | .671 | .412 | .649 | .586 |
| ES | .796 | .777 (23) | .762 | .663 | .380 | – |
| FI | .686 | .709 (25) | .746 | .412 | .481 | .454 |
| GSC | .691 | .729 (18) | .644 | .473 | .366 | .355 |

Table 8. CAEB – Cronbach alpha factor analysis.

| Country | Total | Omitted items (amount) | Factor texture | Factor variability |
|---------|-------|------------------------|----------------|-------------------|
| NL | .782 | .793 (14) | .823 | .727 |
| PT | .904 | .916 (14) | .908 | .821 |
| DK | .852 | .820 (14) | .838 | .769 |
| IT | .822 | .821 (15) | .819 | .760 |
| ES | .809 | .816 (15) | .848 | .776 |
| FI | .732 | .701 (11) | .804 | .531 |
| GSC | .832 | .839 (16) | .837 | .752 |
assessed its similarity with the original translation. When considered necessary, a second translation was performed, which only happened for the Portuguese version. Beaton et al.[19] described the expert team (in this study the project leader and the country teams) to being composed of a methodologist, a health professional and a language professional. The absence of a language professional in most of the teams was a shortcoming in the process.

Every adaptation process has its own dynamics and timeframe. Doing a multi-country cross-cultural adaptation to compare outcomes between different countries poses a challenge between the cultural adaptation in one specific country and the aim of keeping the products comparable for the studies that follow. The main subjects of discussion during the process are presented below.

The different phases in the adaptation process per country influenced how and whether the different countries would affect each other. In the Dutch translation, the decision was made not to use the phrase “in this field” as it was too abstract, and “anchor” for the term “ons vakgebied”, which literally translates to “our discipline”. This seemed to improve the understanding of the questionnaire significantly. This was, partly and in retrospect, confirmed by the study of Muis et al.[28], which advises the use of the term of the specific profession, e.g. physiotherapist, instead of the term “expert”, to improve validity. This adjustment, considered to be a general improvement, was not implemented in all countries because at the time of this deliberation, some questionnaires were already distributed. The discussion around the meaning and the translation of the words “expert”, “professors” and “scholars” in the DEBQ was resolved in deliberation with the project leader to ensure the same meaning, and then considered within the specific language.

English translation was used for the translation of de CAEB. Although published in English in many peer-reviewed articles, to our knowledge, the questionnaire has never been formally adapted for the English language. The translation was discussed within the German team and proven to be satisfactory. The interpretation of the meaning of the terms of the CAEB was, generally speaking, a source of difficulty for both translators and the respondents in the pilot phase. The most common feedback was the feeling that the questionnaire was fairly “abstract”. Some terms seemed to be repetitive but phrased differently, and particularly the term “Negotiated-Discovered” was not always clearly understood.

Since the nature of a semantic differential is to judge about a topic in an associative and evaluative way, the more abstract character was considered to be a part of the construct. It was also hypothesized that the difficulty in giving meaning to some of the terms could have been the result of a more naïve epistemological belief. In this study, the choice was made to stay as close as possible to the wording used in the original article.

### Psychometric analysis

In general, research in epistemological beliefs has shown a low consistency and the factor structure does not always appear to be stable.[11,29] Conceptually, there is still a debate about the number and the nature of the dimensions (factors) and the philosophical considerations that the concept is based upon.[28] Further investigation is required to establish this validity. This study revealed flaws in psychometric values, which are common in other comparable studies.[7,11,30] The general low consistency was confirmed in the adaptation process for the DEBQ. The stability of the CAEB factors turned out to be more consistent than expected based on the difficulties of other studies trying to reproduce the same factors.[30,31]

The DEBQ and the CAEB showed a low-explained variance, which indicated that adding more factors and developing the content validity of the questions could increase this number. Here, the questionnaires are individually discussed in more detail and alternative strategies are presented.

### DEBQ

The proposed 4-factor structure in the DEBQ was present for all seven languages. The low-explained variance, the Kaisercriterion and the amount of omitted items in the questionnaire seemed to indicate a possibility for the existence of other relevant factors. However, in the analysis of the questions of the DEBQ many questions, especially in the factors of “source” and “justification”, seem to be multi-interpretatable, jeopardizing the construct validity of the instrument. Focussing on cognitive validity could reinforce the interpretation of the researchers about the respondents’ opinions. A thorough research of cognitive validity is recommended, using self-report surveys and relying on the interpretation of intrinsically abstract constructs, such as epistemology.[32] Muis et al. [28] have indicated a quite consistent cognitive validity of the DEBQ questions; however, they also state that it can be improved significantly.

### CAEB

The CAEB also revealed an opportunity to add a factor based on the Eigen values of the proposed factors in SPSS® version 22 (Chicago, IL) and based on the content analysis that showed for all countries low loadings on the same four items. It was hypothesized that the lower consistency on the Variability factor for Finland was due to the comparatively low response. This should be further researched.
The relation between the DEBQ and the CAEB

The CAEB and the DEBQ were both employed in order to measure the same construct: sophistication of epistemological beliefs. However, they measured different layers in the concept. Some convergent validity was to be expected, as the certainty/simplicity dimension was similar to the “texture” and “variability” dimensions in the CAEB.[30] The hypothesized correlations between the two instruments on these variables showed weak correlations. Although the correlation was present, its weakness could be explained by the difference between the denotative and connotative nature of the questionnaires (Table 9).

The relation between the countries

The construct validity of the DEBQ and the CAEB is strengthened by the comparable internal consistency of the DEBQ and CAEB questionnaires in total, as well as for the factors showing consistency. The same reasoning is valid for the slight variance in item loading for the CAEB.

Conclusion

All instruments have maintained their initial structure and content allowing for comparison between countries in the future. The two questionnaires DEBQ and CAEB are based on their psychometric properties, sufficiently cross-culturally adapted for their countries. The problems regarding the stability of the factor loading occur in a similar way as in the original instruments. Only those factors with a sufficient consistency can be used in further research, which seems to be different per context and therefore should be treated accordingly.

The existence of the adapted questionnaires could be used to measure the development of the sophistication of epistemological beliefs as a determinant for evidence-based physiotherapy practice in national contexts. The CAEB could also be used in predicting how physiotherapists critically evaluate information within evidence-based practice. Because of the comparability between countries, differences between countries could facilitate dialogue and evoke international development of the underlying concepts of the evidence-based practice movement.

Disclosure statement

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