Culture & Psychology

# Heterogeneity in the conceptions of intelligence of university teaching staff



| | |
|---|---|
| Journal: | *Culture & Psychology* |
| Manuscript ID | CAP-19-0025.R2 |
| Manuscript Type: | Original Manuscript |
| Date Submitted by the Author: | 02-Oct-2019 |
| Complete List of Authors: | Matías-García, José Antonio; University of Seville, Experimental Psychology<br>Cubero-Pérez, Rosario; University of Seville, Developmental and Educational Psychology |
| Keywords: | Teachers, Implicit Theories of Intelligence, Social Discourses, Higher Education, Heterogeneity |
| Abstract: | Using Cultural Psychology as a framework, this research measures and analyses heterogeneity in university teachers' conceptions of intelligence through unguided free-answer semi-structured interviews (N = 20). A new type of analysis, called Heterogeneity by Contradictions Analysis (HCA), was developed. First, a category system was created by making use of the interview data. Then, a series of possible contradictions among pairs of categories was pre-defined. Using these pre-defined contradictions, a systematic sampling of theoretical contradictions could be obtained from discourse. This sampling was then reviewed by the researcher in order to find and code real contradictions, which were later analyzed. 85% of participants presented at least some heterogeneity in their discourse by expressing an idea and its opposite in different parts of the interview. Content of discourse and context are analyzed in heterogeneity expression, which yields future implications for research, intervention, and teacher training. |
| | |





Accepted for publication:

Matias-Garcia, J. A., & Cubero-Pérez, R. (2020). Heterogeneity in the conceptions of intelligence of university teaching staff. Culture & Psychology. https://doi.org/10.1177/1354067X20936926

## Abstract

Using Cultural Psychology as a framework, this research measures and analyses heterogeneity in university teachers' conceptions of intelligence through unguided free-answer semi-structured interviews (N = 20). A new type of analysis, called Heterogeneity by Contradictions Analysis (HCA), was developed. First, a category system was created by making use of the interview data. Then, a series of possible contradictions among pairs of categories was pre-defined. Using these pre-defined contradictions, a systematic sampling of theoretical contradictions could be obtained from discourse. This sampling was then reviewed by the researcher in order to find and code real contradictions, which were later analyzed. 85% of participants presented at least some heterogeneity in their discourse by expressing an idea and its opposite in different parts of the interview. Content of discourse and context are analyzed in heterogeneity expression, which yields future implications for research, intervention, and teacher training.


*Keywords*: Teachers, Implicit Theories of Intelligence, Heterogeneity, Higher Education, Social Discourses

The complex concept of intelligence has been approached from different epistemological and historical positions. Currently, there are competing and complementary theories of intelligence (Garner, 1983; Goleman, 1995; Sternberg, 1985, for some examples). Concepts which have been key in the study of such ability have included inheritance, effort, expectations, context, training, culture, gender, and others (Brinch & Galloway, 2012; Plomin & Von Stumm, 2018; Protzko, Aronson & Blair, 2013). All these theories are what are called explicit theories of intelligence, which are developed within scientific research. Implicit theories, on the other hand, are personal beliefs that are developed through personal and cultural experiences (Sternberg & Davidson, 1986). These theories influence emotions, expectations, and behavior, participating in the everyday life of everyone.

Carol Dweck (1986, 2000) defined two different and opposed conceptions on intelligence: *the incremental theory of intelligence* postulates that intelligence can be modified through continuous work and effort, while *the entity theory of intelligence* argues that intelligence is innate and cannot be modified over the course of a person's life. Adherence to one of those conceptions has been related to both learners' and teachers´ performance in several ways (Dweck, 1986; Renaud-Dube, Guay, Talbot, Taylor & Koestner, 2015; Park, Gunderson, Tsukayama, Levine, & Beilock, 2016).

Teachers' theories of intelligence are related to their teaching practice. Teachers who subscribed to an entity theory of intelligence were found to be more likely to have an outcome-based teaching style (Park et al., 2016) and are more likely to react to students' failures by consoling them for their low natural capacity (Rattan, Good & Dweck, 2012). They engage in ineffective strategies to try to motivate them, thus in fact lowering both their motivation and self-efficacy. Patterson, Kravchenko, Chen-Bouck, and Kelley (2016) also found that teachers more oriented towards entity theories of

intelligence feel less responsible for the academic achievements of their students. Teachers who subscribed to an incremental theory, on the other hand, present higher teacher efficacy (Strosher, 2003), which is related to greater persistence when dealing with struggling students (Gigson & Dembo, 1984), better academic outcomes (Katz & Stupel, 2016), and less teaching-related stress (Senler, 2016).

These intelligence beliefs have been studied as decontextualized conceptions that would operate in all activities the person is involved in in a homogeneous manner (see, for example, Strosher, 2003). Several times, it has been studied as two poles of the same concept, as a continuum, negating the diversity of arguments and opinions that can co-exist within the same person, just for the sake of simplicity or generalization and measuring it as a unique number (Park et al., 2016 for example).

This type of research collides with the perspective developed by Cultural Psychology (Cole, 1996; Cole & Packer, 2019; Cubero, Contreras, and Cubero, 2016; Cubero, Rubio, and Barragán, 2005; Tulviste, 1982, 1989; Valsiner, 2007; Wertsch, 1985, 1989). From this framework, psychological processes have a cultural-historical genesis, where culture is understood as a set of cultural practices or activity settings a person is involved with. These practices are mediated by the use of symbols, signs, and tools that transform talk, thought, and human action (Vygotsky, 1978; Wertsch, 1989). This transformation process from social activities (interpsychological level) to intrapsychological phenomena is called internalization (Wertsch, 1985).

Activity settings are comprised by a set of assumptions about appropriate roles, goals, and means used by participants in that setting (Wertsch, 1985, p. 212). Cognition is, then, functionally related to those activity settings and can vary across each of them. Development is viewed as a process of situated different constructions of cognition

which depends extensively on the demands and activities related to each specific context. It is not a general idea or variable that affects every context, as it seems implicitly thought by research, but rather a set of different ideas associated to (and created within) each context.

Mediated actions by tools, specifically language, are the link between culture and individuals. According to our perspective, social discourses have a sociohistorical development and are culturally situated. As different social discourses exist within cultures, a wide range of possibilities is present for the construction of different semiotic tools that are functionally related to specific activity settings (Santamaria & Martinez, 2005), such as those related to incremental or entity conceptions of intelligence. This leads to variability or heterogeneity of conceptions within individuals, which is explained in terms of the different activity settings in which they participate. According to Zittoun & Gillespie (2015), culture is heterogeneous and fragmented, so we could say that the experiences in different activity settings will be also heterogeneous and fragmented.

As previously stated, research related to intelligence conceptions does not consider the differential development of teachers and learners across different activity settings nor the variability or heterogeneity of conceptions such individuals show in those contexts. Measuring by general decontextualized statements using Likert-like scales cannot grasp the diversity of verbal thinking a person can develop across their lifetime. Several papers regarding conceptions of intelligence point to this diversity too. In a series of studies done by Leith et al. (2014), researchers tested change of implicit theories in participants in several experimental conditions. They found that people modified their implicit theories in accordance with specific aims and social situations. When they encountered a situation that threatened their self-concept or that of

significant others, they strategically hold a more incremental view of change to protect either themselves or others. Poon & Koehler (2006) demonstrated that people have access to both implicit theories of change and stability. The participants in their study explained a series of cases (for instance, the story of an individual who showed marked personality stability through life, or marked change) giving explanations and examples supporting both types of theories, depending on what the case had primed.

As previously stated, we believe such discourses are functionally related to different contexts. We think there is no need to explicitly manipulate participants in order to make heterogeneity appear, as they would occur naturally by simply introducing different semiotic contexts. In a previous study we analyzed conceptions of intelligence among university teachers using an unguided interview in which participants commented on different everyday cases, or vignettes, regarding several aspects of intelligence (Matías-García, 2016). We decided to analyze heterogeneity in their descriptions through the study of contradictions in their discourse. Our goals are the following:

- To ascertain the heterogeneous nature of conceptions of intelligence.
- To determine if heterogeneity varies across different types of concepts and situations, and how does it so.

## Method

### Participants

Participants were selected according to three criteria in order to explore the maximum variety of views we could find: gender, field of knowledge in which they lecture, and years of teaching experience. The sample comprised 20 university teaching staff (10 men and 10 women) from the University of Seville, all of them from Spain, with a mean age of 42.7 and a standard deviation of 11. Four participants were selected

from each field of knowledge, according to the category system in place at the university in question (Table 1). The selection process ensured that half the participants had less than 15 years' teaching experience at the university ($M$ = 6.60, $SD$ = 4.42), and the other half more than 15 years' experience ($M$ = 24.3, $SD$ = 10.1). The only inclusion criterion used was that university teachers had to be currently lecturing at the university, regardless of their position or training.

**Instruments and Materials**

A semi-structured interview was designed, called "Views on intelligence within the educational field" (VIEF) (Appendix A) (Agudelo, 2015, Camas, Caro, Matías-García & Cubero, 2015). The instrument comprises 24 cases, 2 for each of the 12 variables considered. These cases are so called vignettes in some approaches in educational and social research (ÅKerlind, 2005; Kandemir & Budd, 2018). The variables refer to relevant dimensions in which the view on intelligence could be expressed and contextualized. The variables taken into consideration were: Control, Heredity, Effort, Culture, Training, Critical Period, Context, Expectations, Associated Qualities, People, Gender, and Diversity of Intelligence. All those variables have been found relevant in scientific study of intelligence (Brinch & Galloway, 2012; Plomin & Von Stumm, 2018; Protzko, Aronson & Blair, 2013). They are also relevant in the everyday use of the concept in different contexts, such as media, family, school, etc. The average duration of the interviews was 31 minutes.

Authenticity in the interview is achieved by naming neutral authors and phrasing the statements in a simple way - as commonly uttered statements. The vignettes presented followed the same structure: “A source says + a statement related to intelligence”. In order to avoid making it difficult for participants to contradict the statement, sources were never experts in the issue being analyzed. Examples of sources include "a blog",

"a politician", "a mother", and "a popular saying". Sources were never repeated, and both sexes were equally represented within a wide variety of everyday contexts. All statements contained the word "intelligence" or "intelligent", in order to elicit responses related to this concept. Finally, all statements were phrased as something that could be said by a normal person, with no specific concepts or terms from psychological literature being used. The aim was to ensure that they were as similar as possible to statements and assertions that participants would have already heard in their everyday social interactions. Participants are asked to give their opinion about each vignette.

The instrument was tested with two university teachers from the Psychology Faculty and other adults from outside the teaching field. Following the pilot test, the initial position of two items and the phrasing of one question were modified. All interviews were digitally recorded. The Atlas.ti program was used for the qualitative analysis directly onto the recordings, without transcription.

**Procedure**

In order to establish and select the sample group, potential participants were contacted through their university email addresses. All addresses were taken from the University of Seville website. Participants agreed to collaborate in the study after being informed of the objectives and the content of the interview in global terms, situating the contents of the interview on educational topics; they did not receive any incentives. All the interviews were held in the teachers' own offices in Spanish, as it was their mother language, and lasted as much as one hour. All participants were interviewed by the same researcher.

Participants were asked what they thought about each vignette of the interview. In a few situations, if the response was too short or ambiguous in the interviewer's opinion,

participants were asked if they had anything else to add. They were encouraged to express all they wanted.

**Data analysis**

A category system used was used as a tool for coding the participants' descriptions and explanations during the interview. The utterances were segmented and analyzed considering the *unit of meaning* as the unit of analysis. A unit of meaning is a unit of discourse that contains an idea or a theme, which can or not concur with the syntactic unit of the sentence or sentences being presented. A new unit starts in discourse when there is a change in the theme of the content being expressed, i.e. that which is being spoken about. A sentence can contain more than one unit of meaning.

The category system presents 116 units of meaning related to intelligence, organized in 18 different topics. These topics were: Effort, Genetic Influence, Development in Non-Specific Terms, Global Environment, Formal Education, Culture, Activities, Teacher Influence, Parental Influence, Developmental Characteristics, Motivational and Emotional Influence, Others' Expectations Influence, Own Expectations Influence, Other Personal Characteristics Influence, Characteristics Associated to Intelligent People, Gender, Presence of Intelligence in Activities Outside Academic Fields, and Social and Emotional Intelligence. Most categories in this system were developed considering the explicit expression by a participant of the influence or no influence on intelligence of a certain activity, personal characteristic, or contextual factor. Some examples of categories can be *Formal education improves intelligence* or *Formal education does not improve intelligence*. Kappa Index was calculated as an inter-rater reliability measure of the categorization, obtaining a value of 0.861.

A specific type of analysis called Heterogeneity by Contradictions Analysis (HCA) was developed. Using the units of meaning of our system as base, 165 categories of contradictions were pre-defined by the researcher. Each contradiction was defined by two contradictory units of meaning. Two types of contradictions were categorized by taking into account the type of unit of meaning used. If the contradiction was presented between two categories referring to the same idea but opposed in the direction of the relationship with intelligence (for instance, a contradiction between the categories *Effort improves intelligence* vs *Effort does not improve intelligence*), the contradiction was called *Direct Contradiction*. In this type of contradiction, the participant explicitly expresses exactly the opposite to something he/she previously said. The other type of contradiction involves two categories that do not refer to the same idea but should not appear at the same time during the interview by terms of common logic. One example of this would be a contradiction between the categories *Effort improves intelligence* and *Intelligence does not change with age*. The former category expresses how putting an effort in the things you do is important for the development of intelligence, while the latter says that intelligence cannot be modified through your lifetime. However, if it can't be developed during your life, it couldn't be developed through effort nor in any other way. This kind of contradiction related to coherence was called *Coherence Contradiction*.

This relation system of units of meaning was created as a tool for the systematic sampling of verbal contradictions in the interview. For filtering false positive findings, all pairs of contradicted categories were listened to again by the researcher for ascertaining the appearance of real contradictions between categories. Each possible contradiction found by the system was labelled as "Incoherent" (The participant says opposite or incoherent explicit verbal expressions in terms of the proposed relation),

"Uncertain" (There is no sufficient information to know if there is an explicit real contradiction), or "Not Incoherent" (The sentences are expressed in a way that they do not present an explicit contradiction). Only those labelled as "Incoherent" constitutes the corpus of data of this study. Figure 1 summarizes the procedure followed by HCA.

Final contradictions were organized in 21 types of contradictions depending of content (Table 2). These types of contradictions could include either direct or coherence contradictions, or both.

## Results

By applying HCA to data, we found 412 possible cases of contradictions. After the researcher's filtering of data and second coding, 311 contradictions were labelled as "incoherent", 37 as "uncertain", and 64 as "not incoherent". Those labelled as incoherent were analyzed.

For illustration purposes, we present the transcription of two contradictions identified by our procedure and labelled as "incoherent".

In case of vignette 1, *"A boy in his school says that his friend is very intelligent because she puts a lot of effort in everything",* the Physics Studies participant stated:

"Well, being intelligent and effort don't have to be correlated. Being intelligent and putting an effort are different things. Intelligent people will have to put an effort, while those who put an effort will have to acquire knowledge. Apart from that, one thing does not imply the other one."

Categories codified: *Effort does not improve intelligence*; *Learning new knowledge or new abilities do not improve intelligence*.

However, in vignette 3, "*My neighbor says that her daughter of 4 years-old is not so intelligent, but as she is going to start infant school, she thinks her daughter will improve",* the same participant explained:

"(…) Going to school creates intelligence… well, yeah, it provides them with knowledge, with learning how to behave… it helps them in many things and it teaches them."

Categories codified: *Infancy is an important period for the development of intelligence*; *Formal education improves intelligence*; *Learning new knowledge or new abilities improves intelligence*.

By our pre-defined system of contradictions, we found a possible contradiction between *Learning new knowledge or new abilities do not improve intelligence* and *Learning new knowledge or new abilities improve intelligence*. In the first case, the participant doesn't find any relationship between gaining knowledge (through effort) and intelligence. For her, putting an effort and gaining knowledge and being intelligent are both different and non-related things. However, in the second case, in order to defend the development of intelligence by the school, she mentioned its role in providing knowledge. She, then, expressed a link between learning and the development of intelligence. This was codified as incoherent, and, then, a direct contradiction in the *Influence of Learning New Knowledge or New Abilities in Intelligence Development* was found.

Another example is that of the Journalism Studies participant, who affirmed in vignette 2, "*On television, an educational game for improving intelligence in boys and girls, which consists of doing certain activities, has being announced"*, the following:

"Well, I would buy it for my children, of course. You don't lose anything for trying. I guess it might enhance certain cognitive abilities, so it would improve… not only intelligence, but also their own abilities. I mean, it may also improve their linguistic or math areas".

Category codified: *Instruments developed for improving intelligence (games, intervention programs, tv shows) can improve intelligence*.

However, in vignette 23, "*I have read in a blog that, as scientist says, maturation ends in adolescence; intelligence cannot be improved beyond that moment"*, the same participant answered:

"I don't believe... intelligence can grow as you want it to. I mean, you are born with a particular intelligence and you can't go improving it. But you can exploit a lot your other abilities: you can improve your memory, your emotions, your creative areas… by working, by making an effort, you can develop your linguistic or mathematical areas. Everything you work… you are gonna keep improving your knowledge and your field of action. But your intelligence, I don't think it is like a chewing gum, which you can stretch"

Categories codified: *Intelligence does not change along the vital cycle*; *Genetics determine a certain level of intelligence*; *Intelligence (in general, explicitly said) cannot be changed*; *You cannot do anything (in general) to improve your own intelligence*; *Effort does not improve intelligence*; *Learning new knowledge or new abilities does not improve intelligence*; *Emotion or motivation is not related to intelligence development*.

In this case, by our pre-defined system of contradictions we found a possible contradiction between *Instruments developed for improving intelligence (games, intervention programs, tv shows) can improve intelligence* and *Intelligence (in general,*

*explicitly said) cannot be changed*, among others. In the first case, the participant finds a relation between an instrument for improving intelligence, an educational game, and the possibility of intelligence improvement. However, much later in the interview, the participant expressed that intelligence cannot be improved in any way during your life, making it a contradiction. The participant explicit and specifically informs of the improvement in intelligence by a particular activity (an educational game), and not of the possibility (in general) of improving intelligence (which is what she negated later), so the contradiction was categorized as a coherence contradiction in *Use of Instruments Developed for Improving Intelligence Influence*. If she had explicitly negated the effect of such instruments, that would have made a direct contradiction of the same category.

Following this system, the basic unit of the measure of a contradiction cannot be the frequency of contradictions in terms of the category system. Since the category system has been developed for extracting all possible fragments of meaning, there may be overlaps in the counting of contradictions by considering different views of analysis. For instance, in the last example, we have said there is a contradiction between *Instruments developed for improving intelligence (games, intervention programs, tv shows) can improve intelligence* and *Intelligence (in general, explicitly said) cannot be changed*, but there is also between the first and two other categories: *Intelligence does not change along the vital cycle* and *You cannot do anything (in general) to improve your own intelligence*. However, counting three different contradictions because of the characteristics of our tool would overestimate the number of contradictions. Also, we would have too many different types of contradictions (considering each dyad) and content analysis would be difficult. For solving these problems, we calculated the percentages of participants that have expressed a category which has been contradicted elsewhere in the interview by another category, independently of how many times. This

helps us simplify and analyze contradictions regarding content, by focusing on one category of the two (or more) that makes a contradiction. Thus, regarding the previous example, we would consider only one coherence contradiction in vignette 2 in relation to the use of instruments. This helps us understand how heterogeneous the concept of improvement of intelligence is by using instruments designed for that purpose.

General Data

Table 2 shows percentages of heterogeneity related to the whole interview. The percentage of contradicted participants is calculated by dividing the number of participants who have made at least one contradiction related to that concept by the number of participants who have spoken about that concept. As participants were free to speak their minds, not everyone spoke about all studied contents.

Data shows differences in the degree of heterogeneity related to each concept, ranging from 7% to 73%. Several concepts show high degree of contradiction, such as the influence on intelligence of learning new knowledge or abilities, students' effort, formal education, and the means and culture of a country (see Table 2). The last category of the table shows that an 85% of the total number of participants present at least one contradiction in their interview in their arguments related to influence on intelligence and 89% in those related to no influence. See table 2 for details about all categories.

Cases data, context-related differences

Most salient data will be explained. There is a high heterogeneity in the concept the improvement of intelligence by effort. However, almost all of its heterogeneity concentrates in the first case (80% of participants who have made that contradiction), where participants negated effort's influence, while saying the opposite later in many

different cases which were disseminated across the interview in a homogeneous manner. This vignette, "*A boy in his school says that his friend is very intelligent because she puts a lot of effort in everything*", is the only one that explicitly relates learners' effort to intelligence. This leads us to believe that our participants do not directly link situations in which a learner puts a lot of effort with the improvement of intelligence; they rather include the concept of effort when they are speaking about other concepts related to intelligence, as an extra argument to the idea of change and improvement, as another way of improving it.

A similar case is that of the relation between learning and intelligence, which was found the most heterogeneous concept in our participants. Both explanations about the relation and no relation are homogenously disseminated across the interview, but vignette 16, "*A child says he feels intelligent after having learnt to do a new school task"*, which directly links together these two concepts, concentrated most of its heterogeneity. 81% of participants who made that contradiction were found in the negation side (also, 9% on the affirmation side). In fact, sometimes participants even laughed at the item, saying that would be something only a child would say. Learning is also used as an extra-argument for supporting other pro-change ideas, but when a child learns something new, they do not seem to identify an improvement in the child's intelligence. The first example we previously showed to illustrate direct contradictions is also an example of this.

Another interesting context-related data are those of vignettes 11, "*A politician says African children who live in impoverished environments will never become as intelligent as children who live in developed countries"*, and 17, "*In the radio, it has been said that Finnish children are more intelligent because they live in a more developed society"*. Vignette 11 concentrated all contradictions related to the influence

of means and culture of a country, while case 17 concentrated all contradiction related to no influence on intelligence of that same category. In this case, some participants' explanations were in terms of the no influence of the educative system, which explained the differences between countries but had nothing to do with intelligence. Sometimes, this led to new contradictions related to formal education for those participants (50%).

Intra-vignette contradictions

Sometimes, participants made a whole contradiction during their answer to a vignette, meaning that they explicitly expressed a concept and its opposite during their own continuous discourse, without changing vignettes. We found 5 of such cases during our interviews. In those cases, these participants expressed one view first. However, during their own descriptions, they dynamically self-included concepts, ideas, and arguments that made them shift their views. Finally, they ended up telling the opposite argument. It seemed in most cases they did not even realize. Some examples:

Optometry Studies participant, in vignette 5, *In general, people think intelligent people have many friends*, answered:

"I think it's just the opposite, I think it's just the opposite… Many times, based on the stereotype we have of intelligent people, we have the stereotype of a shut-in person, an adult who is locked in their work and many times, when tv programs shows the prototype of intelligent children, they also show a prototype of child who is kind of isolated from the rest, so I wouldn't agree considering the stereotype… But that's the stereotype they propose, I don't think they have to have more nor less friends for being intelligent."

First, he positioned himself in the stereotype of introvert children and obsessed adults who have no friends, but in the end, he negated the stereotypes and claimed there was

no relation between the number of friends and intelligence. A direct contradiction in the *Linkage Between Sociability and Intelligence* was, therefore, found.

Farmacy Studies participant, in vignette 2, "*In television, an educational game for improving intelligence in boys and girls by making certain activities it is being announced"*, answered:

"Well, I think there are activities you can do to train memory, indeed. In fact, there are lots of games for children about colors, of picking cards up… Did you say for training intelligence? I think intelligence can't be trained, can it? Well, you can train memory and become more intelligent by that, but… I don't know."

She said intelligence couldn't be trained, but later, she said you could improve intelligence by training memory. It was coded as a coherence contradiction in the *Use of Instruments Developed for Improving Intelligence Influence*.

## Discussion

Data shows there exists heterogeneity in conceptions of intelligence among participants. Its appearance is high and its degree ranges from 7% to 73% of responses depending of the content being analyzed. Most of research assesses implicit theories of intelligence as a continuum, using instruments like Likert scales and other that, by researcher definition, make them look like that. However, as our study has found, participants' theories do not form a continuum, but a set of different specific constructions of knowledge in discourse. Radical changes in the participants' descriptions can be made depending on semiotic context (Wertsch, 1985), such as saying both that learning improves intelligence and that there is no relation between the two. This differential way of speaking would certainly impact all variables that have been linked to implicit theories of intelligence, as people dynamically change their views (Leith et al., 2014) even without explicit and direct manipulation. A more

contextualized assessment appears to be necessary in order to better grasp these dynamic elements, so we can study how they relate to effects in other variables about learning.

According to Cultural Psychology (Cole, 1996; Cole & Packer, 2019; Cubero, Contreras, and Cubero, 2016; Cubero, Rubio, and Barragán, 2005; Tulviste, 1982, 1989; Valsiner, 2007, 2014; Wertsch, 1985, 1989), we assume participants, during their lives, have participated in different activity settings that presented different goals, roles, and use of words. By means of that participation, they would have acquired and constructed different knowledge and semiotic tools that were functionally related to such activity settings (Santamaria & Martinez, 2005). As different social discourses exist within our culture regarding intelligence, different views are developed. When we begin our interview, we create a context of discourse similar to some activity setting they have experienced, making it possible to express some meanings developed within such activity setting. However, as more vignettes are introduced, elements of different discursive contexts are included, modifying the activity setting and making participants express different descriptions, giving rise to heterogeneity expression. This has been previously found in other studies (Cubero et al., 2005). Sometimes, the change in activity settings was even made by the participant's own discourse, as the appearance of intra-vignette contradictions suggests. They themselves included new concepts or ideas in their answers that led them to an argument or explanation developed within another discursive context, making them express contradictory views. For instance, the Pharmacy Studies participant began by commenting on the existence of educational games developed to improve memory, but that intelligence could not be improved. Then, she came to the realization that intelligence and memory are related and, therefore, concluded intelligence could be developed through memory. It was her

inclusion of the concept of memory, contextualized in educational games for children, what led her to shift her description of intelligence. This can be seen as a way of reconstructing her conceptions, by metacognitively reflecting on her explicit contradictions (Efklides, 2014). However, as her interview continued (by presenting new cases or vignettes that were discursively related to different activity settings), she immediately shifted back to entity descriptions.

We found different degrees of coherence and heterogeneity across different types of content. We could assume that different degrees of heterogeneity would be found considering the different appearance of such arguments in culture as social discourses (Santamaria & Martinez, 2005). Arguments are dependent on content, and society agrees more about certain topics, while other topics show a range of different possibilities of positioning. As more different social discourses arise from different activity settings, more possibilities of contradiction arise, and different degrees of heterogeneity should be found.

Our study also found that although most participants agree in the influence of effort (70%) and learning (75%) in the improvement of intelligence, they don't do so when those same variables are the main topic of discussion, leading to several direct contradictions (44% and 69% of contradicted participants, respectively). When asked about a child who is putting a lot of effort or who is learning and making progresses, they do not identify a possible improvement in intelligence. Conceptions of intelligence of teachers influence students' conceptions of intelligence and are related to their own teaching practice: if teachers express a different theory of intelligence when finding a child of these characteristics, they may act differently, using different social discourses to console them and putting different resources into action than in other circumstances (Park et al., 2016; Rattan, Good & Dweck, 2012). Perhaps, if we train teachers to

identify change in intelligence in students who are learning and putting an effort to improve, we might be able to give them tools to change or maintain their conception of intelligence and, by doing so, affect their teaching methods towards them.

It is worth to note that only three participants had zero contradictions in our interview: the Psychology, Primary Education, and English Studies participants. The Psychology and Primary Education participants had a curricula which specifically meant the study of the concept of intelligence from different theories and current scientific knowledge. English Studies participant said during the interview she had worked with intelligence tests and on language and intelligence matters. This might lead to an expert effect of the internal coherence of concepts as the explicit knowledge has been part of activity settings in their experience. Expert studies have found that experts have richer and more coherent knowledge about their academic domains (Carey & Spelke, 1994; Chi, Hutchinson & Robin, 1989; Chi, Slotta & De Leeuw, 1994), perceive more meaningful patterns, represent problems in at a deeper and principled level, have strong self-monitoring skills, and base their actions on theories (while novices show a more data-driven and opportunistic planning) (Glaser and Chi, 1988; Hsu, Lin, Wu, Lee, & Hwang, 2012; Kuchinke, 1996). In accordance with the previous research, we think university teaching staff, as their scientific experience increase, the different activity settings begin to share a common and coherent structure of knowledge, which might lead to less heterogeneity and more coherence in their implicit knowledge. Nevertheless, more research should be done in order to confirm such hypothesis, since in our study such level of involvement has not been systematically controlled.

Finally, future research should also be done to better characterize heterogeneity and its influence on learning environments. The descriptive nature of this paper helps us understand how these conceptions are, but studies that link coherence/heterogeneity

with actual consequences in learning environments, from both the perspective of learners and teachers, should be interesting in order to better comprehend conceptions of intelligence.

## Conclusions

According to Vygotsky's (1978) approach, there is no single type of development relevant to the explanation of human intellectual functioning, but different types of development or genetic levels, which are the phylogenetic, sociogenetic, ontogenetic, and microgenetic levels (Cubero, 2005). Although Vygotsky made no direct reference to this last level, some authors have indicated that it can be found in his work (Kozulin, 1990; Wertsch, 1985). Through our study, we are able to describe the interaction of the last three domains, which we think is relevant to point out. First, in terms of sociogenesis, this study is framed and refers to the broader sociocultural environment, which exerts an influence on the understanding of intelligence within social groups. This aspect of sociohistorical nature is materialized in the form of social discourses elaborated in the culture and institutional activity settings. Secondly, the ontogenetic level is manifested in the experiential and activity contexts in which each person participates throughout his/her life span. Third and last, in the microgenetic level, we find specific reflections prompted by the vignettes and discursively generated at the specific moment of the interview. Taking all three levels together, we can say that, during the interview, the participants develop discourses, weaving in specific personal life course experiences which in turn are influenced by the sociocultural environment. In this process, the participants construct their personal web of understanding of intelligence in which they can hold contradictory views – without being aware of it.

Conceptions of intelligence are important for many different aspects of teaching and learning. However, they are more complex than most research think they are. Through an unguided free-response interview consisting of vignettes, we have found evidence that support the heterogeneous nature of conceptions of intelligence, and that coherence and perception of intelligence could be trained, as 3 participants showed. We have developed a new technique which elicits implicit assumptions and highlights the heterogeneity of discourse surrounding the concept of intelligence. This technique could also be applied to other "sensitive" areas, such as identities, migration, feminism, and so on.

This type of research yields more context-specific data and more precise measurements of the way participants interact with their environments. The differential usage of ideas about the influence of learning and effort on intelligence is a suitable example of these context-specific measurements. This is in turn important, as conceptions of intelligence influences teaching practices, and students' learning outcomes and well-being.

However, our conclusions are not only important for this population, but also for the way beliefs should be understood. Conceptions are contextually and discursively influenced, making them dynamic and modifiable, so research should bear that in mind in other studies using other different populations. Taking Cultural Psychology as a framework for studying implicit theories or conceptions, we can better grasp beliefs in their complexity.

## References

Agudelo, A.I. (2015). Conceptions of Intelligence within the Educational Environment: Teachers' Implicit Theories (Unpublished Master Dissertation). University of Seville, Spain.

ÅKerlind, G.S. (2005). Academic growth and development - How do university academics experience it? Higher Educucation, 50(1), 1-32. https://doi.org/10.1007/s10734-004-6345-1

Brinch, C.N., & Galloway, T.A. (2012). Schooling in adolescence raises IQ scores. *Proceedings of the National Academy of Sciences of the Unites States of America*, *109*, 425-430.

Camas, L., Caro, C., Matías-García, J.A., & Cubero, R (2015). Interview script instrument "Concepciones de la inteligencia en el ámbito educativo" (CIAE). In Matías-García, J.A. (2016), "Pero Einstein se hartó de trabajar". Concepciones de inteligencia en el profesorado universitario (Unpublished Master Dissertation). University of Seville, Spain. http://hdl.handle.net/11441/66734

Carey, S. & Spelke, E. (1994). Domain-specific knowledge and conceptual change. In L.A. Hirschfeld & S.A. Gelman (Eds.): *Mapping the mind: Domain specificity in cognition and culture.* New York, NY: Cambridge University Press.

Chi, M.T.H., Hutchinson, J.E., & Robin, A.F. (1989). How interferences about novel domain-related concepts can be constrained by structured knowledge. *Merril-Palmer Quarterly, 35*(1), 27-62.

Chi, M.T.H., Slotta, J., & De Leeuw, N. (1994). From things to processes: A theory of conceptual change for learning science concepts. *Learning and Instruction, 4*, 27-43.

Cole, M. (1996). *Cultural psychology: A once and future discipline.* Cambridge, MA, US: Harvard University Press.

Cole; M. & Packer, M. (2019). Culture and cognition. In K. Keith (Ed.), *Cross-cultural Psychology: Contemporary themes and perspectives* (pp. 243-270). NJ, US: John Wiley & Sons.

Cubero, M., Contreras, R., & Cubero, R. (2016). Cultural origins and schooling influence on scientific and everyday concepts: The case of border and citizen on the border concepts. *Culture & Psychology*, *22*(2), 182-205. https://doi.org/10.1177/1354067X15601189

Cubero, M., Rubio, D., & Barragan, A. (2005). Cultura y cognición. La naturaleza heterogénea del pensamiento [Culture and Cognition. The heterogeneous nature of thought]. *Avances en Psicología Latinoamericana*, *23*(1), 119-140. https://doi.org/10.12804/revistas.urosario.edu.co/apl/a.1246

Cubero, R. (2005). Perspectivas constructivistas. La intersección entre el significado, la *interacción y el discurso [Constructivist perspectives. The intersection between* meaning, interaction, and discourse]. Barcelona, SP: Graó.

Dweck, C. (1986). Motivational processes affecting learning. *American Psychologist*, *41*(10), 1040-1048. http://doi.org/10.1037/0003-066X.41.10.1040

Dweck, C. (2000). *Self-theories: Their Role in Motivation, Personality, and Development*. Philadelphia, PA: Psychology Press.

Efklides, A. (2014). How does metacognition contribute to the regulation of learning? An integrative approach. Psihologijske Teme, 23(1), 1-30.

Gardner, H. (1983). *Frames of mind: The theory of multiple intelligences.* New York, NY: Basic Books.

Gibson, S., & Dembo, M. H. (1984). Teacher Efficacy: A Construct Validation. Journal of *Educational Psychology, 76(4), 569-82.*

Glaser, R., & Chi, M.T.H. (1988). Overview. In R. Glaser, M.T.H. Chi, & M.J. Farr (Eds.), *The nature of expertise*. Lawrence Erlbaum, Hillsdale, pp xv–xxvii.

Goleman, D. (1995). *Emotional Intelligence*. New York, NY: Bantam Books.

Hsu, Y.-S., Lin, L.-F., Wu, H.-K., Lee, D.-Y., & Hwang, F.-K. (2012). A Novice-Expert Study of Modeling Skills and Knowledge Structures about Air Quality. *Journal of Science Education and Technology*, *21*(5), 588-606. https://doi.org/10.1007/s10956-011-9349-5

Kandemir, A., & Budd, R. (2018). Using vignettes to explore reality and values with young people. Forum: Qualitative Social Research, 19(2). http://dx.doi.org/10.17169/fqs-19.2.2914

Katz, S., & Stupel, M. (2016). Enhancing elementary-school mathematics teachers' efficacy beliefs: a qualitative action research. International Journal of Mathematical Education *in Science and Technology, 47(3), 421-439.* http://doi.org/10.1080/0020739X.2015.1080314

Kozulin, A. (1990). Vygotsky's psychology: A biography of ideas. Cambridge, MA, US: Harvard University Press.

Kuchinke, K.P. (1996). Experts and expertise: the status of the research literature on superior performance. In Holton EF III (Ed.) Conference proceedings of the 1996 AHRD conference. Academy of Human Resource Development, Baton Rouge, pp 505–512.

Matías-García, J.A. (2016). "Pero Einstein se hartó de trabajar". Concepciones de *inteligencia en el profesorado universitario ["Einstein worked his socks off".* Conceptions of intelligence in university teaching staff] (Unpublished Master Dissertation). University of Seville. Spain. http://hdl.handle.net/11441/66734

Patterson, M. M., Kravchenko, N., Chen-Bouck, L., & Kelley, J. A. (2016). General and domain-specific beliefs about intelligence, ability, and effort among preservice and practicing teachers. *Teaching and Teacher Education*, *59*, 180-190. https://doi.org/10.1016/j.tate.2016.06.004

Poon, C. S. K., & Koehler, D. J. (2006). Lay personality knowledge and dispositionist thinking: A knowledge-activation framework. *Journal of Experimental Social Psychology*, *42*(2), 177-191. https://doi.org/10.1016/j.jesp.2005.04.001

Leith, S. A., Ward, C. L. P., Giacomin, M., Landau, E. S., Ehrlinger, J., & Wilson, A. E. (2014). Changing Theories of Change: Strategic Shifting in Implicit Theory Endorsement. *Journal of Personality and Social Psychology*, *107*(4), 597-620. http://doi.org/10.1037/a0037699

Park, D., Gunderson, E. A., Tsukayama, E., Levine, S. C., & Beilock, S. L. (2016). Young Children's Motivational Frameworks and Math Achievement: Relation to Teacher-Reported Instructional Practices, but Not Teacher Theory of Intelligence. *Journal of Educational Psychology*, *108*(3), 300-313. http://doi.org/10.1037/edu0000064

Plomin, R., & von Stumm, S. (2018). The new genetics of intelligence. *Nature Reviews Genetics*, *19*, 148–159. http://doi:10.1038/nrg.2017.104.

Protzko, J., Aronson, J., & Blair, C. (2013). How to make a young child smarter: Evidence from the database of raising intelligence. *Perspectives on Psychological Science, 8*, 25-40.

Rattan, A., Good, C., & Dweck, C. S. (2012). 'It's ok — Not everyone can be good at math': Instructors with an entity theory comfort (and demotivate) students. *Journal of Experimental Social Psychology*, *48*(3), 731-737. http://doi.org/10.1016/j.jesp.2011.12.012

Renaud-Dube, A., Guay, F., Talbot, D., Taylor, G., & Koestner, R. (2015). The relations between implicit intelligence beliefs, autonomous academic motivation, and school persistence intentions: a mediation model. *Social Psychology of Education*, *18*(2), 255-272. http://doi.org/10.1007/s11218-014-9288-0

Santamaría, A., & Martínez, M. (2005). La construcción de significados en un marco de la Psicología Cultura del pensamiento narrativo [The construction of meanings within a framework of Psychology Culture of narrative thinking]. In M. Cubero y J.D. Ramírez (Eds.), *Vygotsky en la Psicología Contemporánea. Cultura, Mente y Contexto* (pp. 167-193). Buenos Aires: Miño y Dávila.

Senler, B. (2016). Pre-service science teachers' self-efficacy: The role of attitude, anxiety and locus of control. Australian Journal of Education, 60(1), 26-41. http://doi.org/10.1177/0004944116629807

Stemberg, R. J. (1985). *Beyond IQ: A triarchic theory of human intelligence*. New York, NY: Cambridge University Press.

Sternberg, R. J. & Davidson, J. E. (1986). *Conceptions of giftedness: A map of the terrain*. New York: Cambridge University Press.

Strosher, H. L. W. (2003). *Prospective and practicing teachers' beliefs: a study of implicit theories of intelligence and teacher efficacy* (Doctoral dissertation). University of Victoria.

Tulviste, P. (1982). Is there a form of verbal thought specific to childhood? *Soviet Psychology, 2 (1)*, 3-17.

Tulviste, P. (1989). Education and the development of concepts: interpreting results of experiments with adults with and without schooling. *Soviet Psychology, 27 (1)* 5-21

Valsiner, J. (2007). *Culture in Minds and Societies: Foundations of Cultural Psychology*. India: SAGE Publications.

Valsiner, J. (2014). An invitation to cultural psychology. London, UK: Sage.

Vygotsky, L.S. (1978). Mind in society. The development of higher psychological processes. Cambridge, MA, US: Harvard University Press.

Wertsch, J.V. (1985). *Vygotsky: The social formation of mind*. Cambridge, MA, US: Harvard University Press.

Wertsch, J. V. (1989). A Sociocultural Approach To Mind: Some Theoretical Considerations. *Cultural Dynamics, 2*(2), 140–161. https://doi.org/10.1177/092137408900200202

Wertsch, J.V. & Penuel, W.R. (1996). The individual-society antinomy revisited: Productive tensions in theories of human development, communication, and education. In D.R. Olson & N. Torrance (Eds.), The handbook of education and human development, (pp. 415-433). Oxford, UK: Blackwell Publishers.

Zittoun, T., & Gillespie, A. (2015). Internalization: How culture becomes mind. Culture & *Psychology, 21(4), 477 491. https: doi.org 10.1177 1354067X15615809*

Table 1

*Participants, variables, and degrees.*

| Field of Knowledge | Men | | Women | |
|---|---|---|---|---|
| | >15 | <15 | >15 | <15 |
| Arts and Humanities | Fine Arts | History | English Studies | Hispanic Filology |
| Science | Biology | Chemisty | Physics | Math |
| Health Science | Psychology | Optometry | Medicine | Pharmacy |
| Social and Legal Sciences | Law | Primary Education | Labor Relations | Journalism |
| Engineering and Arquitecture | Aerospace Engineering | Computer Engineering | Arquitecture | Materials Engineering |

Table 2

*Data on Contradictions. Influence and No Influence on Intelligence.*

| | | Total % of Contradicted Participants | |
|---|---|---|---|
| | | Influence | No Influence |
| Influence of Effort in Intelligence Development | Direct contradictions | 36% | 45% |
| | Coherence contradictions | 29% | - |
| | Total contradictions | 43% | - |
| Non-Specific Development of Intelligence | Direct contradictions | 18% | 40% |
| Environment Influence in General in Intelligence Development | Coherence contradictions | 29% | - |
| Formal Education Influence in Intelligence Development | Direct contradictions | 23% | 43% |
| | Coherence contradictions | 38% | - |
| | Total contradictions | 46% | - |
| Influence of the Means and Culture of a Country or Context | Direct contradictions | 25% | 30% |
| | Coherence contradictions | 33% | - |
| | Total Contrad | 33% | - |
| Influence of Actions (Non-Specific) in Intelligence Development | Direct contradictions | 14% | 25% |
| | Coherence contradictions | 7% | - |
| | Total contradictions | 21% | - |
| Influence of Learning New Knowledge or New Abilities In Inteligence Development | Direct contradictions | 73% | 69% |
| | Coherence contradictions | 33% | - |
| | Total contradictions | 73% | |
| Influence of Participation in Different Types of Activities in Intelligence Development | Coherence contradictions | 14% | - |
| Different Kind of Intelligences are Developed in Relation to the Type of Activity that is Done | Coherence contradictions | 33% | - |
| Use of Instruments Developed for Improving Intelligence Influence | Direct contradictions | 7% | 33% |
| | Coherence contradictions | 36% | - |

| | | | |
|---|---|---|---|
| | Total contradictions | 36% | - |
| Influence of Teachers in Intelligence Development | Coherence contradictions | 62% | - |
| Influence of Fathers and Mothers in Intelligence Development | Direct contradictions | 7% | 17% |
| | Coherence contradictions | 50% | - |
| | Total contradictions | 50% | - |
| Possibilities of Development of Intelligence Along the Whole Vital Cycle | Coherence contradictions | 8% | - |
| Influence of Motivation and Emotions In Intelligence Development | Coherence contradictions | 14% | - |
| Others' Expectations Influence in Intelligence Development | Coherence contradictions | 17% | - |
| Verbal Positive Reinforcement Influence in Intelligence Development | Direct contradictions | 11% | 13% |
| | Coherence contradictions | 44% | - |
| | Total contradictions | 44% | - |
| Influence of Your Own Expectations in Intelligence Development | Coherence contradictions | 20% | - |
| Linkage Between Sociability and Intelligence | Direct contradictions | 11% | 13% |
| Arguments about Genetic Influence in Intelligence Development | Direct contradictions | 11% | 50% |
| Influence of Personal Experiences In Intelligence Development | Coherence contradictions | 75% | - |
| Social or Emotional Intelligence Development | Direct contradictions | 20% | 14% |
| Arguments About the Modifiability of Intelligence | Total contradictions | 85% | 89% |

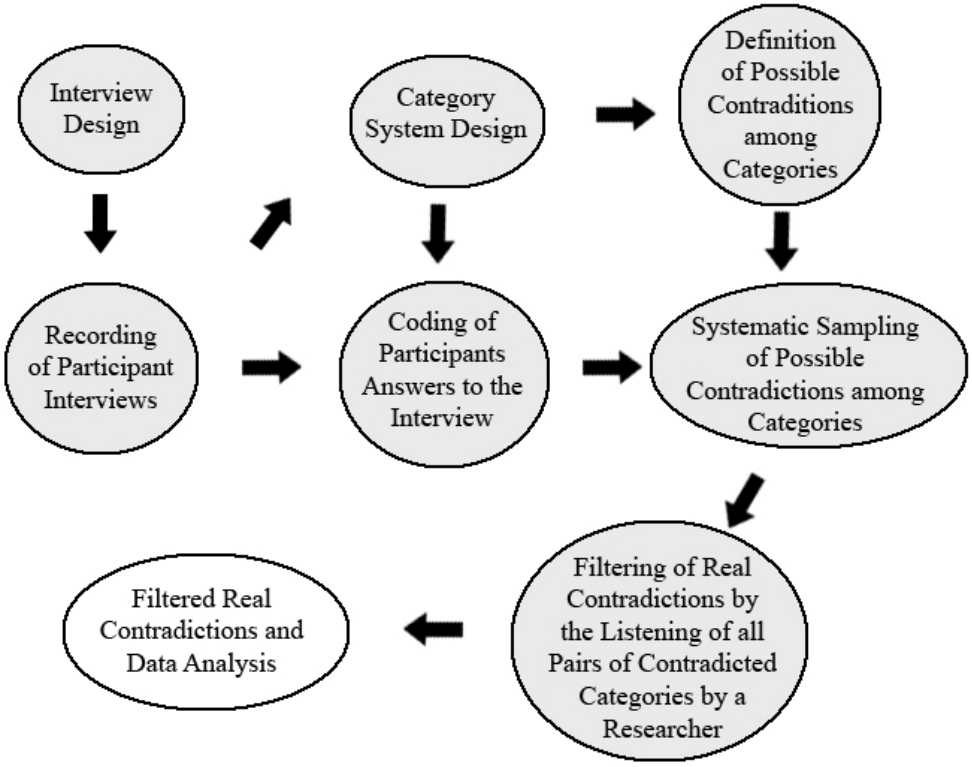


Figure 1. Summary of the procedure followed by HCA.

235x188mm (72 x 72 DPI)

## Appendix A

PROJECT: "CONCEPTIONS OF INTELLIGENCE IN THE EDUCATIONAL FIELD. UNIVERSITY TEACHER'S IMPLICIT THEORIES" (VIEF)

Age: ___ Sex: _____ Field of Knowledge: _____

Teaching experience: _____ Date:_____

Interviewer:_____

We are doing a research about different educational topics. Now, we are going to present you a series of hypothetical cases in which we will ask your opinion about what is being stated in them. We thank your collaboration and your help in the building of knowledge. Once you are ready, we can start the interview.

1. A boy in his school says that his friend is very intelligent because she puts a lot of effort in everything. (Effort Dimension)

2. On television, an educational game for improving intelligence in boys and girls, which consists of doing certain activities, has being announced. (Training Dimension).

3. My neighbor says that her daughter of 4 years-old is not so intelligent, but as she is going to start infant school, she thinks her daughter will improve. (Context Dimension)

4. A collection of proverbs says that you can't be made intelligent; you need to be born intelligent. (Heredity Dimension)

5. In general, people think intelligent people have many friends. (Associated Qualities Dimension)

6. Praising children by acknowledging their brilliance can make their intelligence to be improved. (Expectations Dimension)

7. My cousin, who works in a motorcycle workshop, says he is very intelligent because he is capable of assembling and disassembling a motorcycle in an afternoon. (Diversity of Intelligence Dimension)

8. I have always been told that if you set it as a goal, you can become more intelligent. (Control Dimension)

9. In a Youtube video, it was said that people are born with a certain intelligence that can be improved or made worse depending on what happens to them during their infancy (Critical Period Dimension)

10. I have watched an interview in which a mother says her son doesn't make any effort, nor study and even so, obtains the best scores in his class because he is very intelligent. (Effort Dimension)

11. A politician says African children who live in impoverished environments will never become as intelligent as children who live in developed countries. (Culture Dimension)

12. A mother says she signs her son up for computer, painting, and horse riding classes so they will make him more intelligent (Context Dimension)

13. My grandma says women can become as intelligent as men if they strive for it. (Gender Dimension)

14. A father says to her daughter that whatever she does won't change her intelligence (Control Dimension)

15. According to my teacher, Einstein was a very intelligent person, and all his achievements were not because of his effort, but because he was born with the gift of intelligence. (Heredity Dimension)

16. A child says he feels intelligent after having learnt to do a new school task. (Training Dimension)

17. In the radio, it has been said that Finnish children are more intelligent because they live in a more developed society. (Culture Dimension)

18. My teachers have always told us intelligence and good behavior belong together. (Associated Qualities Dimension)

19. My friend José says that in our species men are more intelligent than women. (Gender Dimension)

20. In Facebook, a secondary education student writes: 'If you believe you are intelligent, you'll finally become an intelligent person, even though you were not'. (Expectations Dimension)

21. An adolescent says he is very intelligent because he knows how to draw very well. (Diversity of Intelligence Dimension)

22. A girl says that thanks to her parents help and support, she was able to become an intelligent person. (People Dimension)

23. I have read in a blog that, as scientists say maturation ends in adolescence; intelligence cannot be improved beyond that moment. (Critical Period Dimension)

24. One of my teachers said: 'If your teachers support you to become intelligent, you'll end up being intelligent'. (People Dimension)