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# Achieving a successful relationship between Neuroscience and Education: The views of Portuguese teachers

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**Abstract**

Educational Neuroscience is currently raising high attention by the educational and neuroscientific community. However, society has created too many expectations concerning what Neuroscience can bring to Education. With this study, we aim to identify eventual distorted expectations of the teachers and propose ways to overcome these. This study was carried out in Portugal with 30 participating schools, where 627 questionnaires were answered by teachers from Preschool to High School. Our results show that there are still misunderstandings concerning the Portuguese teachers' views about the links between Neuroscience and Education. More collaborative efforts between professionals of both fields are needed for the field of Educational Neuroscience to succeed.



Keywords: Educational Neuroscience; teachers view; teacher learning.

## 1. Introduction

There have been many attempts to "marry" Neuroscience with Education since the middle 60s (Willingham, 2009). The creation of 'neuroeducators' was first proposed 30 years ago, based on the belief that brain science might transform and improve the practice of teachers (Cruickshank, 1981). However, the role of Neuroscience in Education is still under discussion (e.g., Fischer, Goswami & Geake, 2010; Samuels, 2009).

For decades, mainstream education has gravitated around behavioral paradigms, reflecting the contribution of Cognitive Psychology (e.g., Piaget, 1952). Since there is no learning without the brain (Goswami, 2004), modern research on learning processes inevitably relates Education with Neuroscience. Thus, teachers face a new dilemma: How to unify Neuroscience and Educational theory and practice? Here, we designed a questionnaire to assess teachers' views concerning the relationship between Neuroscience and Education. With this study, we aim to identify putative distorted expectations and propose ways to overcome these.

Although some cultural and educational concerns may differ from country to country, those related to the widespread of distorted conceptions and expectations of teachers are becoming global. Much like in other countries,

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Portuguese teachers seem vulnerable to misconceptions and this vulnerability stems from the lack of knowledge and time for scientific updates (Rato, Abreu & Castro Caldas, 2010).

## 2. Method

### *2.1. Participants*

Our sample consists of 627 (474 female; 153 male) Portuguese teachers (Preschool to High School) from different areas of expertise (see Table 1). The age of our cohort ranged between 25 and 65 years (M=41; SD=9). Recruitment was carried out in 30 participating schools from nine districts of Portugal and the Islands of Azores and Madeira. Our participants' teaching experience ranged from less than one year to 42 years (M=16; SD=10) and only 23% (N=147) were in training. Of these, 37% (N=54) were enrolled in post-graduate courses (e.g., Masters, PhD), 26% (N=38) focused their service training on their area of teaching and 21% (N=31) on computer science courses; of remaining participants in training, 15% (N=22) attended teaching methodology courses and 1% (N=2) attended neuroscience-related workshops.

Table 1. Areas of expertise and educational stage of teaching.

| Areas of expertise | Educational stage * | | | | | Total |
|---|---|---|---|---|---|---|
| | Preschool | Primary school | Elementary school | Middle school | High school | |
| Unspecified [+] | 31 | 103 | | | | **134** |
| Language and social sciences | | | | | | |
| Languages | | 6 | 20 | 39 | 26 | **91** |
| History/Philosophy | | | 18 | 23 | 37 | **78** |
| Math and economics | | | | | | |
| Mathematics | | | 32 | 52 | 25 | **109** |
| Economy | | | | 3 | 11 | **14** |
| Natural science | | | | | | |
| Biology | 1 | | 4 | 15 | 7 | **27** |
| Sport and special education | | | | | | |
| Sport education | | | 14 | 23 | 17 | **54** |
| Special education | 9 | 20 | 7 | 3 | 1 | **40** |
| Technology and arts | | | | | | |
| Computer science | | | | 10 | 11 | **21** |
| Visual arts/Music/Dance | | 7 | 27 | 15 | 10 | **59** |
| Total | **41** | **136** | **122** | **183** | **145** | **627** |

Note: * The education system in Portugal is divided into five key stages and mandatory for children from 6 to 17 years old. For each school phase we indicate the corresponding age: 3 to 5 years in Preschool; 6 to 9 years in Primary school; 10 to 11 years in Elementary school; 12 to 14 years in Middle school and 15 to 17 years in High school.
[+] In the Portuguese Education system Preschool and Primary school teachers do not usually indicate an area of expertise because they teach several areas.

### *2.2. Measures*

We designed a questionnaire inspired by a study by Pickering and Howard-Jones (2007). In a preliminary set of queries, we assessed the importance attributed by teachers to the understanding of brain functions in educational practice. These initial questions aimed at investigating the attributions given by teachers that might influence their views on the relationship between Neuroscience and Education.

The aim of our questionnaire was to understand how teachers perceive the role of Neuroscience in Education, in order to identify eventual distorted expectations, a second subset of statements were presented and the participants

were asked to agree, disagree, or to express lack of familiarity towards each statement presented. In order to assess if teachers had distorted or true expectations concerning how Neuroscience might contribute to Education, the statements were devised by selecting some of the issues most discussed in the literature concerning the potential of Educational Neuroscience (e.g., Christoff, 2008; Goswami & Szücs, 2010; Fischer, 2009). Two of the 13 statements presented (referring to what might be necessary to achieve a successful relationship between Neuroscience and Education) are not recognized by the neurocientific community and were added to assess the existence of possible false beliefs. The questionnaire is provided in the Appendix.

## 3. Results

According to our data, in the preliminary queries of our questionnaire assessing the importance attributed by teachers to several issues relating the brain and educational practice, 91% (N=571) of the teachers considered understanding brain function very important for an early screening of learning problems. Support for individuals with Special Educational Needs of various origins (e.g., cognitive with 93%) was also attributed high importance by teachers. The application of teaching strategies (87%; N=548), the design of educational programmes (83%; N=518), the decisions about curriculum content (78%; N=491), and the role of nutrition in educational performance (76%; N=478) were also considered important.

In the second subset of 13 statements, our results show that most teachers (83%; N=520) considered that a successful relationship between Neuroscience and Education depends on improved teacher training. The teachers' agreement with the suggested statements was widespread, with the exception of that suggesting the creation of a new transdisciplinary science; this statement obtained only 38% (N=235) agreement from the teachers, although 42% (N=266) were unsure. Teachers also agreed with the two misguided propositions - Neuromyths - that did not stem from neuroscience literature namely, the 'need for neuroscientific answers to all questions of education' (45%; N=282) and the 'need for more brain-based programs' (68%; N=428) (see Figure 1).

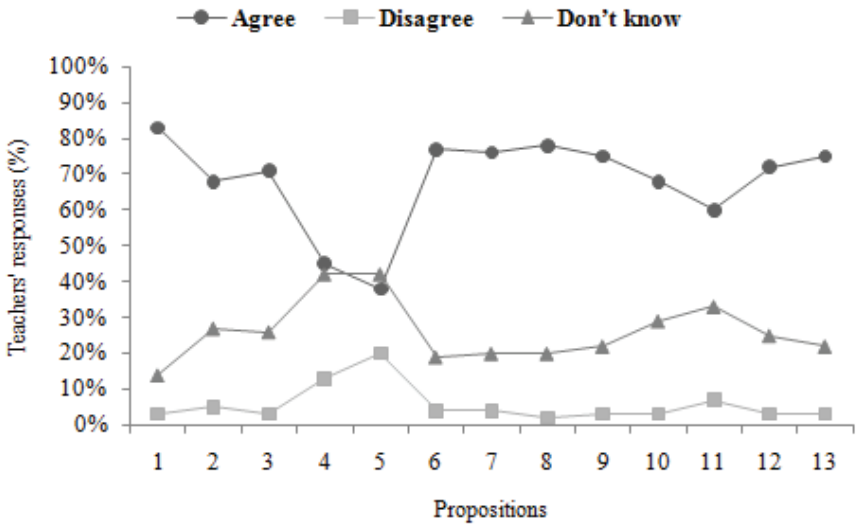


Figure 1. Teachers' responses concerning the 13 propositions suggested for achieving a successful relationship between Neuroscience and Education. Caption: 1. Further training for teachers; 2. Neuropsychologists as mediators to link brain science to education; 3. Research schools - more studies that interrelate a neuroscientific perspective with a school setting; 4. Neuroscientific answers to all questions of education*; 5. Creation of a new transdisciplinary science; 6. Shared vocabulary between neuroscientists and educators; 7. Debunking brain myths.; 8. Collaboration between schools and universities; 9. Two-way dialogue amongst educators and neuroscientists; 10. Spread of programs such as Brain Gym*; 11. Clarification of ethical issues in brain research; 12. Shared databases on learning and development; 13. Conferences involving neuroscientists and teachers. * indicates that this statement is not recognized by the neuroscientific community.

Surprisingly, no differences were found in the % of teacher's responses for each statement between the different areas of expertise, geography and years of practice ($\chi^2$ (60) =35.29, p =.995 ; $\chi^2$ (36) =15.73, p =.999 ; $\chi^2$ (24) =14.09, p =.945, respectively). Hence, the percentage of agreement is similar for each statement, regardless the areas, locations of teaching and years of practice.

## 4. Discussion

Teachers usually show interest in the brain research, although the educational literature poorly discusses the neuroscientific perspective (OECD, 2002). Anglo-Saxon studies of teachers' perceptions on the role of the brain in education revealed an academic enthusiasm operationalized by attempts to interrelate these fields. However, the conceptualizations concerning what this interrelation might entail were not the same for all (Pickering & Howard-Jones, 2007).

Our study revealed that Portuguese teachers also consider that neuroscience could be an ally of their work. Nevertheless, when asked about the importance of the understanding of brain functions in several aspects of educational practice, teachers consider every aspect important alike and do not make significant distinctions about, for example, the role that the brain might have on deciding curriculum contents or on the insights it might bring for intervention with children with Special Education Needs.

According to their responses to the provided statements, teachers acknowledged the need for further training in order to allow this new scientific field to succeed. This was the statement with the highest percentage of acceptance, which may indicate that teachers are attracted to how the brain works but have difficulties in transferring the existing neuroscientific findings to educational practice. Despite the realization that further training is needed to understand the links between Education and Neuroscience, the majority of teachers do not realize the need for a new discipline integrating these two areas. Perhaps introducing the study of Neuroscience in teacher training could dispel some confusions and act as a key factor to achieve a better flow of neuroscientific knowledge between researchers and educators.

Our results also revealed the teachers agreement with our (false) suggestion that the spread of brain-based programs would benefit the success of a neuroeducational field. This distorted expectations might stem from the non-scientific sources where Portuguese teachers look for information (Rato, Abreu & Castro-Caldas, 2010).

According to our data, teachers show a similar pattern of acceptance of the statements presented, regardless of their area of expertise, location of practice or years of experience. This shows that the knowledge of these issues is no different between a Biology or Language teacher, an experienced or trainee teacher, or a teacher from a large city center or a small town. All teachers seem vulnerable to false expectations and this is a sign that action must be taken to eradicate this reality of vulnerability.

As stated by Goswami (2004), educators do not study the learning process at the cell level. Considering the existence of different levels of analysis between Education and Neuroscience, it is imperative that teachers receive neuroscientific information in a relevant and accessible form. Hence, this information has to be clear to avoid misinterpretations.

Society has created too many expectations about what Neuroscience can bring to Education, being some of these beliefs totally unrealistic. It is an illusion to assume that neuroscientific research by itself, will respond to all education queries. This over-expectation concerning the answers given by the study of Neuroscience may be associated with the circulation of misconceptions promoted by popular brain-based educational programmes (e.g., Geake, 2008; Purdy, 2008).

Clearly, it is crucial to unmask the fake classroom applications, which claim to be (neuro-) scientifically based. These so-called brain-based "magic" teaching tools do not derive from Educational Neuroscience.

One way to overcome the misuse of neuroscientific research is to think beyond simple laboratory-to-classroom links and bet on a new discipline to bring together brain scientists and educators. We agree with the investment on neuroeducational research proposed by Howard-Jones (2010), which could be a path to enrich both scientific and educational understanding. Teachers must stop to question their role in this debate (Greenwood, 2009) and be part of it actively. Teachers can contribute to informing cognitive neuroscience research with their unrivalled practical knowledge (Szücs, 2005). Scientific discussions circumscribed to one's own field should come to an end. Scientific discussions require a larger participation of teachers at neuroscientific meetings and vice versa.

Presently, one of the challenges of Educational Neuroscience, and the trigger for its success, seeks the improvement of the scientific dialogue and a shared language in academic and neuroscientific circles. This requires

professionals that master a shared communication across disciplines. Currently, it seems that no such professional is taking the lead at this role in Portugal. Our results show that there are still misunderstandings when teachers are questioned about the links between Neuroscience and Education. The bridge between Education and Neuroscience must have a two-way pathway and Educational Psychology could be the support needed to connect Neuroscience to Education (e.g., Berninger & Corina, 1998; Mason, 2009). While there are still few professionals specialized in Educational Neuroscience, we suggest Educational Psychologists as possible contenders to assume such a role as they seem to be the most skilled to lead these collaborative efforts.

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APPENDIX: Questionnaire Neuroscience and Education
[This is an excerpt from a longer questionnaire, translated from Portuguese]
Rato, Abreu, & Castro-Caldas (2010). ICS, Universidade Católica Portuguesa.

Dear Teacher,

We ask for your cooperation by answering the questionnaire below.
Your answers are intended solely for research purposes. Please respond to all items, otherwise your answers will be discarded.

Age: Male □ Female □ Educational stage tought:
Area of expertise: Number of years of experience as a teacher:

1. Please indicate how much importance you attribute to the understanding of brain functions on the:

| | **Not important** | **Very important** | **Don't know** |
|---|---|---|---|
| 1. Design of educational programmes | | | |
| 2. Application of teaching strategies | | | |
| 3. Early screening for learning problems | | | |
| 4. Decisions about curriculum content | | | |
| 5. Support children with cognitive SEN | | | |
| 6. Support children with physical/sensory SEN | | | |
| 7. Support children with emotional SEN | | | |
| 8. Role of nutrition in educational performance | | | |

2. According to your opinion indicate if you **Agree**, **Disagree**, or, **are not familiar with (Don't know)** the following propositions.

**To achieve a successful relationship between neuroscience and education what is necessary?**

| **Propositions** | **Agree** | **Disagree** | **Don't know** |
|---|---|---|---|
| 1. Further training for teachers. | | | |
| 2. Neuropsychologists as mediators to link the brain science to education. | | | |
| 3. Research schools (more studies that interrelate a neuroscientific perspective with a school setting). | | | |
| 4. Neuroscientific answers to all questions concerning education. | | | |
| 5. The creation of a new transdisciplinary science. | | | |
| 6. Shared vocabulary between neuroscientists and educators. | | | |
| 7. Debunking brain myths. | | | |
| 8. Collaboration between schools and universities. | | | |
| 9. Two-way dialogue amongst educators and neuroscientists. | | | |
| 10. Spread of programs such as Brain Gym. | | | |
| 11. Clarification of ethical issues in brain research. | | | |
| 12. Shared databases on learning and development. | | | |
| 13. Conferences involving neuroscientists and teachers. | | | |