

Coaching leadership and neuroscience

Luca De Gaudenzi, Joana Suta & Lorenzo Pia

Abstract

There is an increasing interest in coaching effectiveness from the world of academia and practitioners. Neuroscience, and its methods, are progressively attracting interest as tools to understand better the added value of coaching related to the leadership theme. Our work aims to contribute to a better understanding of the state of the art of knowledge and evidence regarding the role that coaching/mentoring plays on leadership skills and behaviours by its effects on the brain with by capitalizing on neuroimaging techniques.

The broad findings in our search are that follow-up research that involves additional databases needs to be conducted to have a global view of all scientific literature published in peer-reviewed papers, which represents the gold standard of the quality of scientific research. There is a necessity for a more systematic strategy from the coaching community for a more scientific, evidence-based approach to coaching leadership effectiveness based on neuroimaging techniques.

It is essential to increase awareness among coaching practitioners regarding the limits of using results that are not strictly based on proper scientific evidence as a guide for their intervention and practice.

Keywords: Coaching, Leadership, Neuroscience, Literature review

Introduction

“Coaching is an art: that of helping a person or a group to develop and enhance their professional, relational and personal potential in the realization of their projects and to take their rightful place in the relationship they have with themselves, others and their environment (EMCC Belgium, 2024)”.

The coach-coachee relationship is considered a useful space to cultivate the enhancement of leadership efficiency (Ely and al, 2010). The rapid development of technologies in the field of neuroscience and a better understanding of mechanisms and processes of human brain functioning after the years in the 1990’s has led also to a growing interest in investigating leadership using some of the most advanced methods and technologies associated to neuroscience (Ringleb & Rock, 2008).

The work of Riddel (2021) highlights how the intersection of knowledge from the domain of neuroscience applied to coaching can help us better understand and increase coaching effectiveness.

The conversation on coaching effectiveness, especially in an organizational context, has been the object of study of different contributions covering various aspects over the years. In one well-known recent contribution of meta-analysis related to coaching effectiveness, Wang and colleagues (2021) have identified different features that are useful to define coaching effectiveness; such are aspects related to psychological well-being, performance, learning, and behavioural outcomes.

However, Grover and Furnham (2016) sustained that there is no sufficient evidence regarding the effectiveness of coaching due to the lack of studies conducted in a rigorous way methodologically and the limit related to the sample size (Fingelkurts, Fingelkurts, & Neves, 2020).

Nowadays, the conversation around leadership, coaching, and neuroscience displays great proliferation. A quick search on Google Scholar using these three keywords, “coaching,” “leadership,” and “neuroscience,” displays 22,300 records, which reveals the significant interest in the topic.

In our specific case, our interest is narrowed and focused on coaching effectiveness based on the scientific production of leadership, coaching, and neuroscience. Our choice is guided by the advantage that neuroimaging and neuro-assessment techniques offer in terms of evidence of coaching benefits.

The importance of neuroscience techniques

As mentioned by Jack and colleagues in their article of 2019, neuroscience represents an excellent opportunity for studying human behaviour in an organizational context. The challenges remain in how the researchers will be able to translate abstract conceptualization into systematic technical operationalization and measurements. The different techniques used by neuroscience and their findings can contribute to arriving at grounded conclusions regarding the different mechanisms involved in the mental process and how these can be related to organizational aspects. The eventual opportunities and potential related to using the techniques of neuroscience applied to organizations are more relevant than their eventual limits. It is for this reason of great importance to map the studies that use the techniques applied to neuroscience in connection to organizations.

A short summary of our project

Our interest in this project originates from a work that started with Luca de Gaudenzi, Prof. Lorenzo Pia and Prof. Katuscia Sacco during the years 2013-2015 on the effectiveness of executive coaching using neuroimaging techniques of investigation, such as Functional Magnetic Resonance Imaging (fMRI).

In late 2012, Lorenzo Pia and Luca De Gaudenzi identified the need (arising from the corporate world) to gain solid scientific evidence that “Coaching works”. Thus, in 2013, they started scientific research combining leadership coaching and neuroscience. They capitalized on resting state Functional Magnetic Resonance Imaging (fMRI) aiming at measuring the impact of a coaching development journey on the brain of four executives.

The project results (Sacco, De Gaudenzi, Pia 2015) were presented in Tampere at the 5th Meeting of the Federation of the European Societies for Neuropsychology (September 2015), in Caffarel/Lindt, and at an AIDP (i.e., Italian Association for Personnel Direction) conference.

The current research builds on this original research and aims to understand the state of the art in the scientific literature on coaching and leadership using neuroimaging techniques to provide a better picture of leadership coaching effectiveness based on scientific evidence. The necessity of this work stems from the need for a scientific production of a systematic analysis of the status quo of such literature.

Players Involved

Over time, many persons have been involved in finalizing the project: Weplusnetwork (Sponsor), Prof. Lorenzo Pia (Scientific responsible: Psychology Department, University of Turin, Luca De Gaudenzi (Coach, Mentor and Supervisor – EMCC), Dr. Joana Suta (Business Coach Psychologist, UK; Member of SCP, Italy)

Objectives

The objectives of the study are:

(1) To verify the state of the art of coaching/mentoring knowledge regarding its impact on leadership skills and behaviours by its effects on the brain (Sacco, De Gaudenzi, Pia 2015) with neuroscientific studies applied to coaching which use neuroimaging technique.

(2) Identify new research options.

(3) Add a further brick in the bridge we are building among different disciplines (e.g., Coaching, mentoring, neurosciences, organizational/management sciences) and between academic research and coaching practice.

Method

We decided to use a systematic literature review as a method to define our corpus of data. This choice was guided because of the criteria this method offers to effectively identify and analyse the research papers (Snyder, 2019).

Procedure

In our corpus, we decided to include studies published in peer-reviewed scholarly journal articles, which were based on detailed neurological approaches and methods. The studies should clearly state the connection between business coaching/mentoring, leadership, and neurosciences as the object of their study.

Preliminary criteria

Our criteria for the article to be part of the corpus in analysis was for it to be published in peer-reviewed scholarly journal articles which were based on detailed neurological approaches and methods. In addition, the studies should have clearly stated the connection between business coaching/mentoring, leadership, and neuroscience as the object of their study.

Based on that, as a first step we choose to start our search with the first platform, which should be closer to the studies in neuroscience, which is PubMed. Second, we identified all the possible keywords combinations between the different keywords covering the different techniques used in the field of neuroscience with the keywords of leadership and/or coaching and mentoring. We could identify 24 combinations of keywords that could effectively cover the object of our interest of study.

From a search using 24 different terms of search we had a total of 783 records. (see table Appendix 1). We proceeded with the search and read each of the abstracts, and we could only find one article from Jack et al. in 2013. Based on this search, because of time restrictions, we proceeded to scope our search to Boyatzis and neuroscience. We searched on the database focused on scientific production in psychology PsycINFO, and we "Boyatzis", R AND "Neuroscience". From a corpus of 98 articles based on the abstract, we could identify the same empirical article from Jack and Boyatzis (2013) and some other key theoretical articles related to organizations, leadership, and neuroscience research.

Using cross-search based on some of the most relevant articles mentioned by Jack and colleagues (2019) and articles where they are cited, we could identify two further articles from Fingelkurts et al, (2020) and Puspa and colleagues (2019).

Analysis

The final corpus in our analysis are three empirical peer review publications published from the last decade (2013-2020). The identified articles were analysed qualitatively according to the categories in the table below. First, we define the data relative to the title, year of publication, and keywords. In the second place, we focused our attention on some key aspects of the study's design, such as the number of participants, the duration of the study, and the technique of neuroimaging used. We added some main points about the study's results in the last column.

Authors	Year	Title and Keywords	Neuro-Assessment Method	Main Results
Fingelkurts, A. A., Fingelkurts, A. A., & Neves, C. F. H.	(2020)	<p>Title: Neuro-Assessment of Leadership Training</p> <p>Keywords: Coaching, personalized coaching, transformational leadership, electroencephalogram, EEG, EEG screening profile, brain neuroimaging, leadership, personal characteristics, traits, feedback interventions.</p>	<p>Sample: eleven senior managers -4 months of coaching intervention</p> <p>Neurological screening and scales (Baseline and one week after finishing four weeks of coaching programme)</p> <p>- Electroencephalogram (qEEG) -Psychometrics that measure anxiety and depression (Beck et al. 1998, 1961). - Theoretical framework of reference: Leadership model (FRLM)</p>	<p>The aim of the study is to investigate via neuro-assessment procedure the real self (weaknesses and strengths) in relation to ideal self.</p> <p>The results shows that 71.7% of the senior managers who participated in the tailored coaching program transformational leadership, display an improved in vigilance, memory performance, level of anxiety, resilience and rated lowers scores in psychometrics that measure anxiety and depression.</p>

<p>Puspa, L., Ibrahim, N., Brown, P.</p>	<p>(2019)</p>	<p>Title: 'Wanting' and 'Liking' Brain Mechanisms in Coaching: A qEEG Study Using the CARE Coaching Model</p> <p>Keywords: Coaching, Wanting and liking, qEEG, Delta, Beta-gamma</p>	<p>Sample: six males, middle managers</p> <ul style="list-style-type: none"> -The brain activity was measured using a multichannel EEG. -The neuro-assessment occurred in both rest state and during coaching session coaching session. -The CARE model was used during the coaching session. 	<p>The results showed that a relevant increase of the beta and delta activity of the brain was observed during the coaching session. The increased delta activity was associated with frontal, parietal and occipital areas of the brain. The enhancement beta activity was related to frontal, posterior temporal, and occipital regions. The results of this work are original as they evidence how the model CARE is associated with the motivational mechanisms of "wanting" and "liking" at the same time.</p>
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<p>Jack, A., Boyatzis, R. E., Khawaja, M., Passarelli, A., Leckie, R.</p>	<p>(2013).</p>	<p>Title: Visioning the brain. Keywords: fMRI, Visioning, Mentoring, Coaching, Compassion</p>	<p>Sample: a final sample of 20 participants, undergraduate students, have usable data collected via fMRI.</p> <p>-Coaching and mentoring to the PEA (Positive PEA/vision approach consists of working on Ideal self where the coach reinforced and used as coaching framework, hopes, strengths and desires which refers to Ideal self. Whereas coaching and mentoring to the NEA/needs approach works on Ideal self, which is translated on working on perceived needs for improvement, weaknesses and Real Self.</p> <p>-fMRI technique was used to measure the responses to these two coaching approaches.</p> <p>-Research hypothesized that the PEA coaching is associated to higher level of global visual processing involving the parasympathetic nervous system whereas the NEA approach is associated with a higher activation of sympathetic system.</p>	<p>The results showed that when under the PEA coaching condition, the brain regions involved are related to visioning, positive affect, and parasympathetic nervous system (lateral occipital cortex, superior temporal cortex, medial parietal, subgenual cingulate, nucleus accumbens, and left lateral prefrontal cortex. Whereas the NEA coaching condition is associated with the activation of areas associated to the sympathetic system, negative affect, and negative perception of self (medial prefrontal regions and right lateral prefrontal cortex.</p>
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Table 1. List of empirical contribution on Coaching/Mentoring, Leadership and Neuroscience

Results

All three studies are conducted on relatively small sample sizes. One of them only uses the fMRI as a technique to measure brain activity related to coaching. The other two studies use the EEG technique. All three studies use different theoretical frameworks and models of coaching as a base for their coaching sessions and procedures. This aspect has a double value and interpretation; from one side is an aspect of enrichment regarding the new field of investigation of neuroscience, coaching, and leadership, and from the other side makes the comparison of the results of different studies difficult.

Different from other studies which are more explorative in their nature, the study conducted by Fingelkurts and colleagues (2020) had the ambition of using neuroscience and neuro-assessment procedures to create an ad-hoc coaching intervention programme for each participant. The results show the efficiency of the programme for most of the participants who displayed an improvement in different psycho-cognitive indicators.

Discussion

The results show that the field of coaching, leadership, and neuroscience is in an embryonal state, but some research lines are starting to get defined.

The Intentional Change Theory (ICT) represents a consolidated theoretical framework for one of the three publications considered (Jack et al, 2013). According to the ICT, working on the ideal self is fundamental to creating persistent changes (Boyatzis, 2008). To induce change and personal development in the coachee, the coach must facilitate the formulation of an inspiring vision related to a desirable future (Positive Emotional Attractor, PEA). The change in the coachee becomes possible due to the integration and effective timing of inducing Positive Emotional attractors intersecting them with negative emotions, like fear and anxiety. Facilitating positive emotions is primary in enabling ideas, fueling motivation, directing actions, and allowing the coachee to better achieve his/her goals, creating the conditions for more enduring changes. The study conducted by Jack and colleagues (2013) investigated the role played by the two coaching approaches, the (PEA) and (NEA) and offered evidence via neuroimaging techniques, such as fMRI, of the neural systems involved in the coaching process focused on leadership and mentoring.

This study concluded that coaching based on the coach's compassion and focused on dreams and hopes for the future creates conditions for behavioural changes in the coachees.

The coaching approach focuses on individual weaknesses and sustains compliance with external requests.

When the coach uses the PEA as an approach of reference, there is an activation of the parasympathetic system associated with the activation of the visual cortex of the right hemisphere of the brain, which is deputy to the imagination and general attention.

Differently, the NEA coaching approach is associated with activating the sympathetic neural system and activating the brain areas associated with local attention and primary visual stimulus.

The most recent study published by Jack, Pastorelli, and Boyatzis (2023), even though not explicitly related to the leadership/mentoring theme, focused on coaching and neuroscience, confirmed some main hypotheses formulated by the ICT theory and findings from Jack and colleagues (Jack, Passarelli, Boyatzis 2023) related to coaching effectiveness.

This study, like other studies (Jack and colleagues, 2013), uses the fMRI technique as a privileged technique to study coaching effectiveness. The study confirms that for coaching to be effective it must first work with the coachee's ideal self. After that, the work should be integrated with work in the real self, which is more related to specific goals, deficit performance, derailers, and behavioural aspects. This study offers the opportunity to integrate different theoretical frameworks, such as the Intentional Change Theory, with theories of attention (Passarelli, 2015). This work highlights the role that different coaching approaches play in activating different areas of attention and how this can influence individual responses to coaching and coaching effectiveness.

The work of Fingelkurts, Fingelkurts, and Neves (2020), starts from a general assumption that there is a strong connection between individual differences in terms of personality and neural structure and functioning. Despite a tendency of stability for both structure, organization and brain functioning, they can still be subject to plasticity. Their study aimed to investigate the role that inspirational coaching can play in the plasticity of neural structure and brain functioning both in a resting and awake state using the Electroencephalogram (qEEG) technique and psychometrics to develop leaders. The EEG technique was chosen by Fingelkurts, Fingelkurts, and Neves (2020), showing different benefits, among many of them low costs and not being invasive. The main idea is to create a personalized leadership program where the EEG technique can offer further insight into personalizing the coaching process. They started their work based on previous findings regarding the normative distributions of certain parameters of qEEG in healthy functioning individuals (Basar, 1998; Gevins, 1998 to mention some of them (for more details, see their original article). The values that fall outside this range are evidence of particular neurological dysfunctions. The authors measured via qEEG nine screening profiles associated with leadership development. Some of them are vigilance, information speed, resilience or anxiety level, and overall brain resources. The qEEG results show an improvement in different metrics and optimization of the overall brain, which are associated with transformational leadership: for example, being able to control emotions, being able to maintain a level of optimism despite difficulties or being able to maintain a low level of anxiety. Their study is an example of how integrating knowledge and methods from different areas can give more support and clarity to the neurological bases for effective leadership.

The EEG assessment method was used in the study conducted by Puspa, Ibrahim, and Brown (2019), like Fingelkurts, Fingelkurts, and Neves (2020). In this case, the so-called CARE model is used during the coaching sessions to measure the efficiency of a specific coaching approach. The results show the activation of delta and beta activity of the brain during the coaching session related to different areas of the brain, revealing how this coaching model could be associated with the activation of motivational mechanisms related to "wanting" and "liking."

Conclusion

The handful of studies analysed in this work showed that despite the different theoretical frameworks or different coaching approaches used in these studies all of them show significant results of coaching effectiveness.

The broad findings in our search are that follow-up research involving additional databases needs to be conducted to have a global view of all scientific literature published in peer-reviewed papers, representing the gold standard of the quality of scientific research. There is a necessity for a more systematic strategy from the coaching community for a scientific, evidence-based approach to coaching leadership effectiveness based on neuroimaging techniques.

It is essential to increase awareness among coaching practitioners regarding the limits of using results that are not strictly based on proper scientific evidence as a guide for their intervention and practice. The results of our search help demystify the link between neuroscience and executive coaching based on scientific evidence and protect the profession's reputation from potential damage through unfounded claims and applications of neuroscience within coaching and mentoring.

Limits of the study

The limitation of our approach is that for a matter of time and resources, our search was restricted to a few databases. Initially, we conducted a comprehensive search in the PubMed database. This database par excellence gathers peer-reviewed published papers that encompass, among other publications, publications in the field of neuroscience. After that, we narrowed our search for a matter of time and resources to PsycINFO only to Boyatzis, R., and neuroscience. Another limitation was that our search was focused on peer-reviewed empirical papers. This was because we were focused on ensuring only a high quality of evidence.

Implications and Future prospectives

The measure of our success will, firstly, be the publication of our current results and then, secondly, more extensive research, which includes additional databases and enlarging the scope of the study.

We would like this work to inspire further debate in the coaching community for more systematic work on coaching, neuroscience, and leadership. A measurement of the success will be the creation of an ad hoc group to collaborate with other colleagues under the guidance of the European Mentoring and Coaching Council (EMCC) Global on new coaching-leadership projects combined with neuro research. Ideally with the sponsorship of EMCC. As a future prospective, the creation of a scientific journal focused on scientific literature production on coaching leadership and neuroscience.

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Appendix 1

Keywords	Main technique	Records	Retrieved (July - August 2022)	Relevant
Leadership				
coaching AND "magnetic resonance"	Magnetic resonance	91	08/07/2022	1
leadership AND "magnetic resonance"		158	08/07/2022	
coaching AND "MRI"	"MRI"	48	08/07/2022	
leadership AND "MRI"		99	08/07/2022	
coaching AND "Positron Emission Tomography"	"Positron Emission Tomography"	5	08/07/2022	
leadership AND "Positron Emission Tomography"		34	08/07/2022	
coaching AND "PET"	"PET"	16	08/07/2022	
leadership AND "PET"		47	08/07/2022	
coaching AND "Diffusion Tensor Imaging"	"Diffusion Tensor Imaging"	2	08/07/2022	
leadership AND "Diffusion Tensor Imaging"		5	08/07/2022	
coaching AND "DTI"	"DTI"	2	08/07/2022	
leadership AND "DTI"	"DTI"	4	08/07/2022	
Mentoring				
mentoring AND "magnetic resonance"	"Magnetic resonance"	54	08/07/2022	
mentoring AND "MRI"	"MRI"	25	08/07/2022	
mentoring AND "Positron Emission Tomography"	"Positron Emission Tomography"	4	08/07/2022	
mentoring AND "PET"	"PET"	11	08/07/2022	
mentoring AND "Diffusion Tensor Imaging"	"Diffusion Tensor Imaging"	1	08/07/2022	
mentoring AND "DTI"	"DTI"	No result was found. Your search was processed	08/07/2022	

		without automatic term mapping because it retrieved zero results.		
Total		606		
coaching AND "Electroencephalogram"	Electroencephalogram	6	21/08/2022	
leadership AND "Electroencephalogram"		9	21/08/2022	
			21/08/2022	
coaching AND "EEG"	EEG	26	21/08/2022	
leadership AND "EEG"		38	21/08/2022	
			21/08/2022	
mentoring AND "Electroencephalogram"	Electroencephalogram	6	21/08/2022	
mentoring AND "EEG"	EEG	13	21/08/2022	
Database PsycINFO				
Keywords		Records	Retrieved	Relevant
"Boyatzis, R." AND "Neuroscience"		25		1

Table 1. The keywords used for the search in the PubMed platform.