Supplementary Table 1: Specific data on PNE

Name - Scientific literature

Reference	Specific data *Must answer the question: "What term refers to PNE?*
Adenis et al (2020) [17}	Pain neuroscience education, pain neurophysiology education
Dolphens et al (2014) [62]	Pain neuroscience education, Therapeutic pain neuroscience education
Lane et al (2018) [19]	Pain neuroscience education
Malfliet et al (2017) [20]	Pain neuroscience education
Malfliet et al (2019) [22]	Pain neuroscience education
O'Keefe et al (2015) [69]	Pain education
Vier et al (2018) [70]	Pain education
Werner et al (2010) [57]	Intensive neurophysiology education
Wälti et al (2015) [71]	Neurophysiological education, education on the neurophysiology of pain
Agarwal et al (2020) [23]	Pain neuroscience education
Anandkumar et al (2018) [24]	Therapeutic pain neuroscience education, pain neuroscience education
Bodes Pardo et al (2018) [54]	Pain neurophysiology education
Clarke et al (2011) [5]	Pain neurophysiology education
Gallan Martin et al (2019) [53]	Pain neuroscience education
King et al (2018) [48]	Pain neurophysiology education
Louw et al (2012) [58]	Neuroscience education
Malfliet et al (2019) [21]	Pain neuroscience education
Mansouri et al (2018) [73]	Pain neurophysiology education
Moseley (2004) [46]	Pain physiology education
Moseley (2005) [44]	Pain physiology education
Moseley et al (2004) [47]	Neurophysiology education, pain neurophysiology education
Moseley (2003) [45]	Pain physiology education
Nijs et al (2017) [27]	Pain neuroscience education
Nijs et al (2014) [26]	Pain neuroscience education, therapeutic pain neuroscience education

Nijs et al (2011) [31]	Pain physiology education, ‘pain (neuro)physiology education’ or ‘pain biology education’
Orhan et al (2019) [28]	Pain neuroscience education
Petersen et al (2019) [29]	Pain neuroscience education
Pires et al (2015) [53]	Pain neurophysiology education
Puentedura et Louw (2016) [30]	Pain neuroscience education
Rizzo et al (2018) [67]	Pain biology education, pain education
Rufa et al (2018) [31]	Pain neuroscience education
Ryan et al (2010) [68]	Pain biology education
Saracoglu et al (2020) [32]	Pain neuroscience education
Saracoglu et al (2020) [33]	Neuroscience pain education
Tegner et al (2018) [65]	Neurophysiological pain-education
Tellez-Garcia et al (2015) [49]	Neuroscience pain education, neuroscience education, neurophysiology education
Toomey et al (2020) [34]	Pain neuroscience education
Ünal et al (2020) [35]	Pain neuroscience education
Van Wilgem et Keizer, (2012) [59]	The sensitization model
Wood et Hendrick (2019) [60]	PNE has been named in different ways: therapeutic neuroscience education, or “explain pain”. Pain Neuroscience Education is used for the purpose of the article
Moseley et Butler (2015) [2]	PNE has been named in different ways: therapeutic neuroscience education, pain biology education, pain neuroscience education. Explain pain is used for the purpose of the article
Louw et al (2016) [36]	PNE has been named in different ways: Explain Pain, pain neuroscience education, pain biology education, therapeutic neuroscience education. Pain Neuroscience Education is used for the purpose of the article
Moseley (2003) [42]	Pain physiology education
Louw et al (2017) [37]	Pain neuroscience education, de-education
Diener et al (2016) [12]	Therapeutic neuroscience education
Wijma et al (2016) [55]	Pain neuroscience education
Louw et al (2017) [60]	Pain neuroscience education
Moseley (2002) [41]	Neurophysiology education
Louw et al (2017) [51]	Neuroplasticity explanation
Lotze et Moseley (2015) [40]	Explaining Pain
Blickenstaff et Pearson, (2016) [38]	Pain neuroscience education

Barbari et al (2020) [14]	Pain science education
Ibrahim et al (2019) [56]	Patient education
Ibrahim et al (2018) [61]	Patient education
Nijs et al (2015) [39]	Pain neuroscience education
Galan-Martin et al (2020) [25]	Pain neuroscience education

Name - Clinician educational resources

Reference	**Specific data** *Must answer the question: "What term refers to PNE?*
Louw et al (2018) [13]	Pain neuroscience education
Moseley et Butler (2017) [18]	Explain pain

Definition - Scientific literature

References	**Specific data** *Must answer the question: "What is PNE?"*
Adenis et al (2020) [17]	PNE is an educational strategy aimed at explaining to the patient their pain experience, prognosis, and treatment options from a neurobiological perspective.
Agarwal et al (2020) [23]	PNE is a new cognitive therapy for patients with chronic pain teaches the patient about the biology and physiology of their pain experience.
Galan Martin et al (2019) [18]	PNE is an educational health strategy that aims to provide up-to-date information from neuroscience regarding chronic pain.
King et al (2018) [48]	PNE is an educational and cognitive-behavioral intervention that involves explaining pain biology to the patient.
Lane et al (2018) [19]	PNE is an educational intervention used by physical therapists to help patients understand the biology, physiology, and psychosocial factors that influence their pain experience, and to reconcile them with the maladaptive thoughts and beliefs associated with chronic pain.
Louw et al (2012) [58]	PNE is a form of CBT which aim of increasing knowledge and understanding of pain, and thus decrease fear associated with musculoskeletal disorders.
Moseley (2004) [46]	PNE is an individualized educational session that provides information on nociception and pain.
Nijs et al (2014) [26]	PNE is about explaining central sensitization to the patient using evidence from modern neuroscience.
Nijs et al (2011) [31]	PNE is education on central sensitization and its role in chronic pain
Orhan et al (2019) [28]	PNE is an educational model that explains pain from a biological and psychological perspective to the patient.
Pires et al (2015) [53]	PNE is a cognitive-behavioral intervention that uses the explanation of the neurophysiology of pain to alter pain-related illness beliefs, disease perception, and coping strategies, in order to promote a return to normal activities, and reduce levels of pain and disability related to movement.
Puentedura et Louw (2016) [30]	PNE is teaching people about the neurobiology and neurophysiology of pain.
Ryan et al (2010) [68]	PNE is a new cognitive-behavioral intervention that attempts to reduce pain and disability by educating the patient about pain biology.

Saracoglu et al (2020) [32]	PNE is one of the many cognitive therapy methods often implemented alongside manual therapy and exercise.
Saracoglu et al (2020) [33]	PNE is a new cognitive education method to explain pain to patients with chronic low back pain.
Tegner et al (2018) [6]	PNE is a cognitive-behavioral intervention in the form of a verbal intervention that provides education in the neurophysiology of pain to change maladaptive disease beliefs, alter maladaptive pain cognitions, and re-conceptualize pain.
Tellez-Garcia et al (2015) [49]	PNE consists of educational sessions describing the neurobiology and neurophysiology of pain, as well as the treatment of pain in the nervous system.
Vier et al (2018) [70]	PNE is a biopsychosocial approach that demystify fear-avoidance beliefs about pain and movement, and explains how pain is not necessarily linked to tissue damage or degeneration, and how biological, psychological, and cognitive factors influence pain perception.
Wälti et al (2015) [71]	PNE is a cognitive approach.
Werner et al (2010) [57]	PNE is a cognitive education program that is theoretically based on contemporary knowledge of pain mechanisms.
Wood et Hendrick, (2018) [60]	PNE differs from traditional pain education by aiming to desensitize the neural system by focusing on neurophysiology, neurobiology, pain representation and pain meaning, instead of using an anatomical and traditional biomedical model.
Moseley et Butler, 2015) [2]	PNE is a range of educational interventions aimed at helping the patient to change their understanding of pain; its meaning, purpose, and biological processes that underpin it. It refers to the theoretical framework used for treatment and the approach itself, rather than a series of specific techniques or procedures. PNE focuses on helping the patient to gain a functional understanding of pain by explaining the key biological concepts behind it. PNE is different from other educational strategies due to its emphasis on conceptual change, and is not: 1) advice on how to move in pain, manage their pain, manage their activity, set goals or solve problems (CBT); 2) an explanation of Gate Control Theory; 3) a statement that the cause of the pain is linked to an irreducible sensitization of the central nervous system; 4) a rejection of biomedical models in favour of only focusing on psychosocial factors; or 5) a discrete intervention to be used in addition to treatment strategies based on a model of structural pathology.
Louw et al (2016) [36]	PNE is a strategy for explaining to people the biology and physiology of their pain experience, with the aim of reducing their pain and disability
Diener et al (2016) [12]	PNE is an educational biopsychosocial approach aimed at helping the patient understand their painful experience from a neurological and physiological perspective in order to produce a therapeutic outcome.
Wijma et al (2016) [55]	PNE is a patient-centered and individualized explanation of central sensitization, including biopsychosocial interactions.
Louw et al (2017) [37]	PNE is an educational strategy that focuses on explaining the neurobiological and physiological processes involved in pain, with the aim of altering beliefs and cognitions about their pain experience.
Lotze et Moseley (2015) [40]	PNE is a range of educational interventions that aim to change the person's understanding of what pain really is. PNE differs from other pain education strategies derived from CBT, which are limited to the application of scientific principles (e.g. pain does not equal injury, moving despite the pain, pain is inevitable but suffering is optional), while PNE covers the science itself. PNE is a management approach rather than a set of techniques, and is integrated with CBT.
Blickenstaff et Pearson (2016) [38]	PNE is a biopsychosocial, cognitive, and educational approach whose goal is to modify the patient's beliefs and thoughts about pain through the lens of physiology.
Louw et al (2016) [64]	PNE aims to teach the patient about pain from a biological and physiological point of view, increasingly adopting a biopsychosocial approach.
Barbari et al (2020) [14]	1) Educational strategies are the processes used by clinicians to encourage patients to make informed decisions and use reasoning related to their condition; 2) They differ from communication strategies, whose goal is to maximize the interaction and exchange of ideas or concepts between the clinician and the patient to enhance the therapeutic bond and adherence to treatment; 3) PNE differs from educational strategies that focus on a biomedical model, such as ergonomics, biomechanics, back schools, postural exercises, or traditional TM; 4) Rather, it is based on a biopsychosocial vision that is in line with recent advances in neuroscience and CLBP research.
Ibrahim et al (2019) [56]	PNE is a psychosocial or cognitive education that emphasizes self-management strategies.

Definition - Clinician educational resources

Reference	Specific data *Must answer the question: "What is PNE?"*
Louw et al (2018) [13]	1) PNE is the explanation to the patient of his painful experience with the latest knowledge on pain, while de-emphasizing him from tissue problems; 2) Pain reconceptualization by PNE refers to cognitive restructuring, while the physical treatment refers to the behavioural part; 3) One point of view is that PNE is more than a treatment technique, but an approach that permeates all aspects of care.
Moseley et Butler (2017) [18]	1) In a broad sense: PNE can be defined as a way of thinking about pain; 2) In a more targeted sense: PNE is not a single technique but a range of conceptual change strategies based on pain science.

Objective(s) - Scientific literature

Reference	Specific data *Must answer the question: "What is the goal of PNE?"*
Adenis et al (2020) [17]	The main objective is to help the patient reconsider their pain, from a sign of tissue damage / deterioration, to a sign of the sensitivity of their protective systems, influenced by a combination of biological, psychological and social factors. The other goal is to increase their adherence to active rehabilitation strategies based on a biopsychosocial framework and to enhance their perceived benefits.
Agarwal et al (2020) [23]	The objective is to teach the patient the biology and physiology of their painful experience.
Anandkumar et al (2018) [24]	The objective is to re-conceptualize the pain, address concerns about their back, and provide reassurance.
Bodes Pardo et al (2018) [54]	The objective is to alter patients' beliefs, as a pre-requisite for behavioral change.
Galan Martin et al (2019) [18]	The objective is to change cognitions by altering erroneous beliefs and decreasing catastrophizing, kinesiophobia and avoidance.
Clarke et al (2011) [5]	The objective is to improve patients' understanding of their pain.
King et al (2018) [48]	The aim is to reduce maladaptive beliefs and behaviours in order to reduce pain and disability.
Lane et al (2018) [19]	The objectives are to: 1) help patients better understand the biology and psychosocial factors associated with their pain experience; 2) reconcile them with their inappropriate thoughts and beliefs; 3) increase intrinsic motivation through self-efficacy and therapeutic alliance.
Louw et al (2012) [58]	The objective is to increase knowledge and understanding of pain, thus reducing fear related to musculoskeletal disorders.
Malfliet et al (2019) [22]	The objective is to reduce the perceived threat of pain by increasing knowledge about pain and re-conceptualizing it.
Malfliet et al (2017) [20]	The objectives are to: 1) Reconceptualize pain; 2) Optimize the therapeutic alliance (cornerstone of the neuroscience-based approach).
Moseley (2004) [46]	The objective is to help the patient understand their pain by understanding the physiological mechanisms underlying it, rather than just having a cognitive-behavioral response to it.
Moseley (2005) [44]	The objective is to modify patients' understanding of their painful condition (reconceptualizing the problem).
Nijs et al (2017) [27]	The objectives are to: 1) Transfer knowledge of pain neuroscience to the patient, enabling them to better understand their own pain and thus better manage it; 2) Enhance beliefs about pain, decreasing pain threat, including painful flare-ups from exercise and daily physical activity; 3) Prepare for cognitive-targeted exercise therapy.

Nijs et al (2014) [26]	The objectives are to: 1) Change beliefs by re-conceptualizing pain; 2) Convince patients that pain is not a result of tissue damage; 3) Make sense of pain without imaging abnormalities; 4) Transfer this knowledge to patients to prepare them for exercise therapy that is time-contingent, rather than symptom-contingent.
Nijs et al (2011) [31]	The objective is to modify understanding of their painful condition and to re-conceptualize their pain.
Orhan et al (2019) [28]	The objectives are to: 1) enhance coping strategies in the face of pain by changing misguided pain beliefs; 2) shift their understanding of pain from a threatening signal to an alarm signal that protects the body, emphasizing the disproportionate nature between tissue damage and pain.
Petersen et al (2019) [29]	The objective is to address high levels of fear-avoidance beliefs.
Pires et al (2015) [53]	The objective is to modify illness-related beliefs about pain, perception of disease, and coping strategies, in order to introduce a return to normal movements and activities, and to reduce levels of pain and disability.
Puentedura et Louw (2016) [30]	The objectives are to: 1) Reconceptualize pain by teaching more about the neurobiological and neurophysiological processes involved in the painful experience rather than focusing only on tissue pathology; 2) Shift the focus away from tissue as the main source of the problem and emphasize a thorough understanding of the pain experience as a path to eventual recovery.
Rizzo et al (2018) [67]	The objective is to help the patient understand the biological processes involved in the experience of pain.
Rufa et al (2018) [31]	The objective is to alter the beliefs of patients with chronic pain. PNE aims to influence elements such as kinesiophobia and catastrophism in order to reduce pain, increase tolerance to movement and reduce disability.
Ryan et al (2010) [68]	The objectives are to: 1) Reduce pain and disability by explaining the biology of pain; 2) De-medicalize the painful condition; 3) Shift attitudes towards a biopsychosocial self-management approach; 4) Emphasize that pain is not equal to injury; 5) Decrease fear associated with activity through physical activity sessions trained in a graduated manner.
Saracoglu et al (2020) [32]	The objectives are to: 1) Change misperceptions and incorrect beliefs about pain; 2) Educate the patient that pain can occur even without an injury, and that pain can become overprotective.
Saracoglu et al (2020) [33]	The objective is to alter patients' attitudes and beliefs regarding pain.
Tegner et al (2018) [6]	The objective is to change maladaptive disease beliefs, alter maladaptive pain cognitions, and re-conceptualize pain
Tellez-Garcia et al (2015) [49]	The objective is to help patients increase their understanding of their pain and thereby decrease fear of movement or re-injury, by explaining to them the neurophysiological mechanisms underlying chronic pain.
Toomey et al (2020) [34]	The objectives are to: 1) Increase the patient's understanding of the neurobiology of pain, and specifically the weak correlation with tissue damage; 2) Provide the therapist with the opportunity to move the patient's focus away from a persistent tissue issue; 3) Explore the psychological factors and social influences affected by pain.
Ünal et al (2020) [35]	The objective is to enable the patient to understand the neurobiology and neurophysiology of their pain experience.
Van WIlgem et Keizer (2012) [59]	The objectives are to: 1) Reconceptualize the somatic beliefs of an anatomical defect linked to their pain; 2) Provide an opportunity to provide a physical explanation for chronic pain through changes in the nervous system.
Wälti et al (2015) [71]	The objectives are to: 1) Reduce patients' perception of pain and disability, reconsider protective behaviors and self-restraint resulting from fear of movement; 2) Help them regain a confident and positive outlook on their abilities and recognize the beneficial effects of activity.
Wood et Hendrick (2019) [7]	The objective is to re-conceptualize pain as a marker of body tissue protection rather than a marker of injury.
Moseley et Butler (2015) [2]	The objectives are to : 1) Help the patient change their understanding of pain: what it represents, its function, and the biological processes that it is based on; 2) Change a person's conception of pain from a marker of tissue damage (or disease) to a perceived need to protect body tissues; 3) The goal is for patients to

	understand their pain and to incorporate this new understanding into their beliefs, attitudes, behaviors, treatments, and lifestyle; 4) Change the understanding of pain from a structural biomedical paradigm to a truly biopsychosocial paradigm; 5) Acquire a functional pain literacy.
Louw et al (2017) [21]	The objectives are to: 1) Help people reduce their pain and disability; 2) Help people modify their behavior that contributes to pain and disability (through PNE and associated cognitive-behavioral therapies); 3) Help people understand (reconceptualize) that their pain is not a direct indication of the state of their tissues, without implying that the pain is "all in their head".
Moseley (2003) [42]	The objectives are to: 1) Reduce the perceived threat of pain; 2) Increase the patient's knowledge of human physiology, and re-conceptualize their pain.
Diener et al (2016) [12]	The objectives are to: 1) Help the patient gain an understanding of their pain experience from a neurological and physiological perspective; 2) Produce a therapeutic effect.
Wijma et al (2016) [55]	The objective is to help progress through the stages of behavior change (Prochaska)
Louw et al (2017) [37]	The objectives are to: 1) Change beliefs and cognitions about their painful experience; 2) Convince the patient that the presence of central sensitization implies that the brain produces more pain signals independently of what is happening in the tissues.
Moseley (2002) [41]	The objective is to address cognitive and behavioral factors by re-conceptualizing the problem and providing information.
Lotze et Moseley (2015) [40]	The objectives are: 1) to provide a biological justification for the treatment; 2) To shift the understanding of pain from a sign of tissue damage or pathology, to a sign of the perceived need to protect body tissues.
Blieckenstaff et Pearson, 2016) [32]	The objectives are to: 1) Change the patient's beliefs and thoughts about pain; 2) Provide experiences aimed at reducing perceived pain-related threat; 3) Generate positive expectations for improved pain and function; 4) Create a reasonable context to explain the pain and invite the person to explore movement.
Louw et al, (2017) [64]	The objectives are to: 1) Help patients gain an understanding of their pain from a biological and physiological perspective; 2) Facilitate a change in behavior and encourage movement despite the pain.
Ibrahim et al (2019) [61]	The objectives are to: 1) Provide non-threatening information to enable a better understanding of pain; 2) Change unhelpful beliefs about low back pain; 3) Encourage active coping strategies and secure pacing; 4) Integrate self-management strategies; 5) Promote positive attitudes and healthy behaviors.
Nijs et al (2015) [39]	The objectives are reconceptualization and deep learning.
Galan-Martin et al (2020) [58]	The goal is to understand each component of the exercise program.

Objective(s) - Clinician educational resources

References	**Specific data** *Must answer the question: "What is the aim of PNE?"*
Louw et al (2018) [13]	The objectives are to : 1) Help people understand and re-conceptualize their pain from a biological and physiological perspective based on current knowledge; 2) Processing maladaptive cognitions to modify the pain experience; 3) Helping people understand that pain is a normal human experience.
Moseley et Butler (2017) [18]	The objectives are to: 1) Re-conceptualize his pain deeply; 2) Identify and increase SIMs (Cognitive and Behavioral Factors of Safety). Target concepts targeted by the conceptual change: i) Understanding why and how it hurts is part of the treatment; ii) Pain receptors do not exist; iii) Pain depends on the perceived danger/safety balance; iv) Pain depends on the context; v) Pain involves multiple brain activity; vi) When the danger persists, the protection systems are sensitized; vii) Pain is one protection system among others; viii) We are bioplastics; ix) Learning about pain can help move forward; x) Active strategies promote recovery.

Content - Scientific literature

References	**Specific data** *Must answer the question: "What does PNE cover?"*
Adenis et al (2020) [17]	Educational content covers: 1) Deconstructing erroneous patho-anatomical and patho-mechanical beliefs initially; 2) Second stage education in pain biology; 3) The persistence of pain is less related to healed tissues, but more related to the sensitization of protective systems influenced by a combination of biopsychosocial factors; 4) Treatment options include movement, physical activity, stress and emotional management, with an emphasis on dosage and progressivity (rather than biomechanics and the need for tissue protection).
Agarwal et al (2020) [23]	PNE utilizes metaphors, examples, and visuals to educate patients about the neurobiology and neurophysiology of their painful experience.
Anandkumar et al (2018) [24]	Educational content covers: 1) Explanation of the origin of pain and its treatment through the nervous system; 2) Difference between acute and chronic pain; 3) Factors that favor the persistence of pain; 4) Focus on the multidimensional link between exercise addiction and persistent low back pain; 4) Establishing concerns about back fragility. Examples: i) lack of association between pain and MRI abnormalities; ii) spontaneous regression of herniated discs (with images); iii) explanation of the effect of mistaken beliefs and catastrophism on pain with the neuromatrix model; iv) video of the 3 tissue healing phases; v) pictures of visual illusions to demonstrate the importance of the brain's inaccurate perception; vi) normal time for tissue healing; vii) spine model to show that the spinal cord is well protected; viii) permanent co-activation of the trunk muscles and repetitive exercises can increase the load on already sensitized spinal structures and contribute to the maintenance of pain; ix) relationship between poor body perception, thoughts and beliefs, and persistence of pain, etc.
Bodes Pardo et al (2018) [54]	Educational content is based on the Explain Pain book and Pain in Motion content.
Clarke et al (2011) [5]	PNE provides a detailed explanation of the underlying neurophysiology of chronic pain using pictures and metaphors, with a special emphasis on the brain and its role in thoughts and attitudes.
Galan Martin et al (2019) [18]	Educational content covers: 1) Epidemiology of chronic pain; 2) Pain as an alarm system; 3) Pain is not equal to damage; 4) Psychosocial and cultural aspects of pain (session 1); 5) Differences between acute and chronic pain; 6) Danger assessment system; 7) Amplification and inhibition systems; 8) Pain as a brain response (session 2); 9) Consequences of chronic pain and central sensitization; 10) Movement, motor control disorder, and kinesiophobia; 11) Fear-avoidance behaviors; 12) Pain catastrophizing; 13) Structural and functional disturbances that generate persistent pain (session 3); 14) Knowledge as a tool in the evaluative process of sensory stimuli; 15) The belief system and its epigenetic effects; 16) Reversibility of structural and functional changes; 17) Neuroplasticity mediated by cognitive and somatosensory stimuli, and physical exercise; 18) Benefits of group exercise (session 4); 19) Review of the contents covered in the first four sessions, and of the most relevant aspects of the PE group sessions.
Dolphens et al (2014) [63]	Educational content is focused on the physiology of the nervous system in general and pain in particular. Content and pictures are based on the 'Explain Pain' book."
King et al (2018) [48]	Educational content is based on the book 'Explain Pain'".
Louw et al (2012) [58]	Educational content includes pictorial and metaphorical explanations of: 1) the peripheral nervous system; 2) the central nervous system and neuromatrix; 3) other protective systems; 4) treatment options. Summary 1: An analogy of an ankle sprain is used to explain lumbago (injury, inflammation, sensitization of peripheral nerves, desensitization, scarring). Acute pain is contrasted with persistent pain where nerve sensitization persists despite tissue scarring. This phenomenon is explained by the presence of certain factors such as fear of pain, stress related to family, work, anxiety, and different explanations. The good news is that the more we understand this, the more the nerves become desensitized.
Malfliet et al (2017) [20]	PNE states that 100% of pain is generated by the brain, and that chronic pain is more likely caused by hypersensitivity of the central nervous system rather than by local tissue damage.
Mansouri et al (2018) [73]	Educational content covers: the origin of pain (tissues and nociceptive pathways), the role of the brain (cerebral decoding based on the assessment of perceived danger) and the factors that influence the perception of pain. Different classifications of pain are based on duration (acute or chronic) and mechanism (nociceptive or neuropathic). Other components include sensory-discriminative, affective-emotional, cognitive and behavioral aspects. The ascending gate control theory, and ways to modify pain (such as modifying beliefs, physical activity, relaxation, etc.) are also discussed.

Moseley (2004) [46]	Educational content covers neurophysiology of nociception and pain, more specifically: 1) Neuron (receptor, axon, terminal); 2) Synapse (neurotransmitter, ion channels, postsynaptic membrane, action potential); 3) Descending pathways of facilitation and inhibition; 4) Peripheral sensitization; 5) Central sensitization (increase in synaptic efficiency and number of postsynaptic receptors).
Moseley (2005) [44]	PNE provides information on the physiology of the nervous system and the mechanisms of pain in particular, using pictures, examples and metaphors. This information can be understood by people who have not received an education. The comprehensive content is described in the “Explain Pain” book.
Moseley et al (2004) [47]	Educational content includes information specific to the nervous system, such as the functional importance of each component, neurotransmitters, postsynaptic receptors, and the concept of a "volume knob" of post-synaptic excitation and inhibition. It is content-based on the current knowledge in neurophysiology of pain based on the work of Wall and Melzack. However, there is no specific information on the lumbar spine or mention of emotional and behavioral patterns associated with chronic pain (e.g. catastrophism, kinesiophobia). There are three different sections: 1) Presentation of the nervous system in general with a focus on nociceptive pathways and pain; 2) Presentation of synapses with a focus on the 2nd neuron (medullary); 3) The adaptability of the nervous system (includes afferent and efferent pathways, physiological peripheral and central sensitization, receptor synthesis, axonal germination, neuronal response to activity and control of movement).
Moseley (2003) [45]	Educational content covers the physiology of pain and injury
Nijs et al (2014) [26]	The content of the sessions is based on the book Explain Pain and covers several themes: 1) the characteristics of acute versus chronic pain; 2) the function of acute pain; 3) how pain arises in the nervous system (nociceptors, ion channels, neurons, action potential, nociception, peripheral sensitization, synapse, intersynaptic space, inhibitory and facilitatory chemicals, spinal cord, descending inhibitory and facilitatory pathways, role of the brain, pain memory, pain perception), 4) how pain becomes chronic (plasticity of the nervous system, modulation, central sensitization, pain neuromatrix theory).
Nijs et al (2011) [31]	The educational content is based on the book Explain Pain, covering the physiology of the nervous system and that of pain in particular. The various themes include: 1) the characteristics of acute versus chronic pain; 2) the function of acute pain; 3) how pain arises in the nervous system (nociceptors, ion channels, neurons, action potential, nociception, peripheral sensitization, synapse, inter synaptic space, inhibitory and facilitatory chemicals, spinal cord, descending inhibitory and facilitatory pathways, role of the brain, pain memory, and pain perception); 4) how pain becomes chronic (plasticity of the nervous system, modulation, central sensitization, and pain neuromatrix theory); and 5) potential maintenance factors for central sensitization, such as emotions, stress, perceptions of illness, cognitions of pain, and pain behavior.
O’Keeffe et al (2014) [69]	Educational content is based on the following themes: 1) Contemporary understanding of pain and the nervous system; 2) The multidimensional nature of chronic low back pain; 3) Common myths about chronic low back pain, posture, and ergonomics; 4) Exercise, relaxation, and sleep.
Orhan et al (2019) [28]	Unlike traditional educational models, PNE focuses on the neurobiological mechanisms, representation and meaning of pain, explaining the biological and physiological processes that underlie the experience of pain. The educational and visual content was based on: 1) previous research; 2) specific guidelines; 3) educational books (e.g. Explain Pain, Pijneducatie). Themes: 1) Difference between acute pain and chronic pain; 2) Protective role of pain; 3) Process of formation of acute pain in the nervous system; 4) How pain becomes chronic; 5) Potential central sensitizing factors; 6) Treatment strategies. The slides used for the PowerPoint were taken from "Pain Neuroscience Education: Slides for Supporting and Illustrating Your Explanation" from the Pain In Motion group.
Petersen et al (2019) [29]	Educational content covers neurophysiology of the processes underlying pain, peripheral sensitization, and the fact that pain does not necessarily equal injury.
Pires et al (2015) [53]	Educational content is based on content from Butler and Moseley's book and Nijs guidelines, this course covers the following topics: 1) how acute pain arises in the nervous system; 2) transition from acute pain to chronic pain; 3) central sensitization; 4) the role of the brain in the perception of pain; 5) psychosocial factors related to pain; 6) cognitive-behavioral responses to pain; 7) the management of painful outbreaks and 8) pacing. Content is supported by metaphors and images.
Rizzo et al (2018) [67]	Educational content is based on information from the Explain Pain book. The themes: 1) pain as a normal experience; 2) integration and function of the danger alarm system and modulation of the danger messages in the spinal cord; 3) altered central nervous system alarm and pain response systems; 4) education and understanding that pain is not equal to injury, and stimulation and gradual exposure.
Rufa et al (2018) [31]	Unlike other educational strategies, PNE puts less focus on pathoanatomical content and more focus on teaching the various factors that contribute to the development of pain. Educational content is adapted from the book “Why do I Hurt” and tailored to each patient. The themes discussed in this content are: 1) The purpose of pain: pain as an alarm system warning of actual or potential injuries, how pain can affect thoughts, emotions, actions, and activities; 2) peripheral

	nerves: signal transmission (including synapses and neurotransmitters), the ability to modify peripheral nerves; 3) central nervous system: the role of the brain in pain production, the influence of beliefs, emotions, and attention on pain production; 4) chronic pain: the disconnect between pain and tissue damage, its unsuitable nature; 5) treatment strategies: the benefits of knowledge, stress relief, sleep hygiene, exercise, and gradual activity re-entry.
Ryan et al (2010) [68]	Educational content includes information on the biology of pain
Saracoglu et al (2020) [32]	Educational content covers: 1) Pain physiology; 2) Nociplastic pain; 3) The virtual body in the brain; 4) Changes in bodily perception related to pain; 5) The psychosocial dimensions of pain. PNE uses neurophysiological information to make the patient understand that pain can occur even in the absence of injury and that pain can become overprotective. Session 1: Peripheral neuropathic pain, peripheral nerve sensitization, allodynia, central sensitization, hyperalgesia; Session 2: Neuroplasticity, diffuse pain, central sensitization, hyperalgesia, allodynia; Session 3: Biology of stress, immune response, emotional overload, fear, catastrophizing and pain; Session 4: How to deal with pain? The role of exercise and manual therapy.
Saracoglu et al (2020) [33]	Educational content includes (with metaphors, images, graphics and anecdotes) teaching about the physiology of pain, central sensitization, body representation in the brain, changes in body representation due to pain, psychosocial dimensions of pain, fear of pain, and how these are affected by treatment. During the PNE sessions, it was explained that the nervous system can be overprotective and that in addition to the sensitivity of the central nervous system, nociceptive transmission can be affected by an individual's thoughts, beliefs, and environment. Session 1: Definition of the following terms: peripheral neuropathic pain, peripheral nerve sensitization, central sensitization, allodynia, hyperalgesia and neuroplasticity; Session 2: The role of central sensitization, hyperalgesia, allodynia on their symptoms. Why their pain expands, the role of neuroplasticity in chronic pain; Session 3: Biology of stress, immune response, emotional overload, fear, catastrophizing and their role in pain; Session 4: How to deal with pain? The potential effect of manual therapy and pain education in neuroscience.
Tegner et al (2018) [65]	PNE is explaining to the patient the key biological concepts underlying pain
Tellez-Garcia et al (2015) [49]	Educational content covers the neurophysiology of pain, without reference to the spine, discussing the distinction between acute and chronic pain. With additional information on the impact of beliefs and attitudes on pain.
Toomey et al (2020) [34]	Educational content includes: 1) Reassuring the patient that their pain is real even though the tissues may not be at risk; 2) Explaining the neurobiological and psychological mechanisms of manual therapy and the low biological plausibility of certain concepts such as “correcting subluxations”; 3) Understanding the biological processes that underlie pain; 4) Understanding that pain can become overprotective; 5) Understanding how psychosocial factors can positively and negatively modulate pain; 6) Using a diary to reflect the factors of good and bad days; 7) Identifying specific movements that the patient is apprehensive about, and breaking them down into small, manageable chunks; 8) Using breathing and mindfulness techniques. Resources: a) YouTube video (Tame the Beast, Why Things Hurt, Understanding Pain in Less than 5 Minutes); b) Books (Painful Yarns, Explain Pain); c) Analogies (Pain as an Alarm System; The Role of Expectations in Treatment; How Manual Therapy Can Provide Relief in Realigning Bones).
Unal et al (2020) [35]	Educational content covers pain mechanisms; central pain treatment; how the nervous system is sensitized in chronic pain; factors that cause chronic pain; side effects related to fear avoidance. But also: neurophysiology of pain, nociception and nociceptive pathways; neurons, synapses, action potential, spinal inhibition and facilitation; sensitization device; awareness center; plasticity of the nervous system. All explained with simple images, stories, leaflets, metaphors, drawings.
Van Wilgem et Keizer (2012) [59]	Anti-theft alarm metaphor to explain central awareness: "It's like having an anti-theft alarm system in the house that is always turned on."Metaphor of the thermostat to explain continuous chronic pain (e.g. fibromyalgia, headache): "It's like the thermostat is set too low, which causes the house to constantly overheat."
Vier et al, (2018) [70]	Educational content covers: 1) the importance of pain in our lives; 2) how pain is a useful warning sign that something may not be right; 3) what factors contribute to the chronicization of pain; 4) the significance of psychosocial factors such as stress, anxiety, and kinesiophobia in the chronicization of pain; 5) the role of insufficient sleep and physical activity in back pain; 6) the benefits of gradual exposure and daily movements; 7) the neurophysiology of pain; 8) the nocebo effect; 9) the lack of correlation between posture, imaging, and pain. In the other sessions: reinforcing the concepts mentioned above.
Wälti et al (2015) [71]	Educational content is based on a Randomized Controlled Trial (RCT) by Moseley et al. It provides an overview of the biopsychosocial model of chronic low back pain, including cortical dysfunction of pain and bodily perception. The focus is on how this model can explain the participants' characteristics of low back pain experiences.

Werner et al (2010) [57]	The content consists of an understanding of pain that differs somewhat from the traditional injury model. The content is based primarily on the neurophysiology of pain, reflecting sensitization and neuronal response to inactivity and control of movement. Based on this, the program has three basic elements: 1) reducing the perceived threat; 2) targeting the patient's understanding of pain; 3) exposure to threatening inputs.
Wood et Hendrick (2019) [60]	Educational content focuses on neurophysiology, neurobiology, representation and meaning of pain, instead of relying on the traditional anatomical and biomedical model (where is the lesion and how to fix it).
Moseley et Butler (2015) [2]	PNE aims to explain key biological concepts related to pain. These concepts are: 1) the variable relationship between nociception and pain; 2) the concept's powerful influence on pain; 3) upregulation of the nociceptive system (sensitization) when pain persists; 4) the coexistence of several protection systems (including pain); 5) the potential influence of other protective systems on pain; 6) adaptability, and therefore the ability to re-train our biology (including but not limited to the concept of neuroplasticity); 7) and the knowledge that this adaptation is likely to be slow. PNE may contain: 1) explanation of the biological processes underlying the pain; 2) PNE relies on multimedia design and principles to present the biology of pain; 3) the teaching that pain can become overprotective; 4) teaching that nociceptive messages can be up-regulated in the spinal cord; 5) teaching that nociceptive messages can be down-regulated by the brain; 6) the teaching that the nociceptive system can become hypersensitive leading to more nociceptive messages, but it is still the brain that decides whether or not to produce pain; 7) it is reassuring that the pain is still real even if the tissues may not be in danger.
Louw et al (2016) [36]	Educational content covers: 1) De-education: sharing normative data on imaging exams (e.g. Brinkji chart 2015) and helping them understand that abnormalities may not be associated with pain (and reduce catastrophizing and kinesiophobia); 2) Pictorial and simplified description of the nervous system; 3) Comparison of the nervous system to a highway network; 4) Comparison of the nervous system to an alarm system; 5) Analogy of the foot stepping on a nail to explain tissue injury, peripheral sensitization and desensitization, scarring; 6) Explanation of chronic pain: nerve tenderness persists while tissues have healed (graphs); 7) Proposal of factors (yellow flags) to explain why for some people, the sensitivity persists (images); 8) Impact of nervous system sensitization on function and morale (graph); 9) Proposal of a treatment plan to desensitize the nerves (including PNE and other conservative therapies).
Moseley (2003) [42]	PNE differs from other conventional education strategies (which focus on the anatomy and physiology of the spine), and includes detailed information on the neurophysiology of pain: 1) the neuron (specific receptors, nerve endings, axon) ; 2) the action potential (all or nothing law, postsynaptic membrane potential, propagation, dromic and antidromic flow); 3) the synapse (neurotransmitters, inhibitory and facilitating inputs, chemically controlled ion channels, ion channel synthesis and uptake); 4) primary nociceptors (danger receptors); 5) 2nd order nociceptors (sum of inhibitory and facilitating inputs, inhibitory interneurons, project to several parts of the brain); 6) cerebral production depends on the total perception of danger, all information relevant to this decision-making is taken into account: thoughts, memories, beliefs, explanatory models, consequences); 7) descending inhibitory and facilitatory pathways (dependent on the total perception of danger); 8) state-dependent functioning of the primary nociceptor: potentiation and summation, ectopic discharge, dorsal root ganglion, neurogenic inflammation, allodynia and hyperalgesia; 9) state-dependent functioning of 2nd order nociceptors: potentiation, blocking of active ion channels, increase in receptor synthesis, germination, activation by endocrine mediators
Diener et al (2016) [12]	Educational content covers: 1) Dispelling misconceptions about tissue health; 2) Explaining pain from neurobiology and physiology.
Louw et al (2017) [60]	PNE includes: 1) An alarm system metaphor for understanding central sensitization. The nervous system is compared to an alarm system to contrast sensitivity before and after the onset of pain. In some people, the alarm system does not settle down, leaving them with an oversensitive alarm system; 2) Manual therapy is presented as a transitional technique to recover range of motion and facilitate the activation of endogenous opioids.
Moseley (2002) [41]	Educational content is focused on the neurophysiology of pain without reference to the lumbar spine.
Louw et al (2017) [51]	Educational content includes: 1) A simplified, literal explanation of Penfield's homunculus as a virtual map of the body; 2) When we move less in a region, the map of that region blurs; 3) When we move a blurred region, we experience more pain; 4) It is possible to redraw the maps of the brain; 5) Manual therapy can help with this process.
Barbari et al (2020) [14]	Educational content includes: 1) Explanation of concepts and presentation of the neurophysiology of pain; 2) Explaining the nervous system, synapses and neuroplasticity based on the "Textbook of Pain" by Melzack and Wall, with diagrams and examples; 3) Focusing on topics such as the origin of acute pain in the nervous system, the transition from acute to chronic pain, central sensitization, the role of the brain in the perception of pain, the role of psychosocial factors related to pain, pain-related cognitive and behavioral responses, pain flare-ups and pacing through the use of metaphors and images; 4) Biology of pain using diagrams and freehand drawings; 5) Neurophysiology of acute and chronic pain, as well as the role of beliefs in relation to pain based on the book Explain Pain; 6) Content focused on vicious circles of pain, psychosocial factors involved in pain, awareness and the difference between pain and injury; 7) Neurophysiology of pain, cortical dysfunction, and body perception.

Ibrahim et al (2018) [56]	Educational content covers: 1) Interactive session: Meaning of low back pain: Justification of treatment and expected objectives. Accepting that you have lingering pain, then starting to move on. Importance of setting realistic goals or action plans. Participants were allowed to tell their story/experience about low back pain; 2) Meaning of low back pain: definitions of low back pain (nonspecific vs specific, acute vs chronic, epidemiology, explosion of disability and associated costs; 3) Low back pain facts: common, not serious, recurrence is common but not serious; 4) Beliefs about low back pain: some beliefs about low back pain (pain equals injury, physical activity, rest, etc.). Fear-avoidance beliefs and behaviors can promote the persistence of pain; 5) Basic anatomy: solidity of the structures of the spine and difficulty of injuring it; 6) Cause of pain: poor radio-clinical correlation, poor prognostic predictor, use of imaging in the presence of red flags; vii) Pain can be felt without any physical changes in the body; viii) Return to normal activities: Most pain in the spine is due to muscle, ligament, and joint strain, and stopping movement can cause these structures to become weak. To keep the back healthy, it needs to be active; ix) Other topics: a) Coping and pacing strategies; b) Self-management; c) Postural hygiene; d) Increasing activity levels; e) Modifying lifestyle; f) Warning signs and what to do.
brahim et al (2019) [51]	Educational convent covers: 1) the meaning of low back pain; 2) facts about low back pain; 3) beliefs about low back pain; 4) the strength of the spine; 5) the cause of pain; 6) the basis of pain physiology; 7) staying active and resuming normal activities; 8) coping and pacing strategies; 9) modifying lifestyle; 10) Low back pain red flags.
Nijs et al (2015) [39]	Pain neuroscience content rather than psychology content. Introduction to time contingent exercise.

Content - Clinician educational resources

References	**Specific data** *Must answer the question: "What does PNE cover?"*
Louw et al (2018) [13]	Educational content addresses the neurophysiological mechanisms of pain, and signs/symptoms, factors, and treatment options in a neurophysiological manner. 1) Neurophysiological mechanisms of pain (ion channels, nociception, peripheral sensitization, central sensitization, spinal inhibition & facilitation, pain is a production of the brain according to the perceived threat, the neuromatrix of pain, the homunculus biology of stress , sympathetic, endocrine and immune responses, inflammatory responses, impaired brain function, cortical blurring, positive neuroplasticity): 2) signs and symptoms (hyperalgesia, allodynia, diffuse pain, sensitivity to cold and stress, loss of function, swelling problems, physical fatigue and sensitive muscles, intestinal problems, neuropathic pain); 3) associated factors (stress, anxiety and fear, emotion, catastrophizing, sleep problem, past treatments, etc.); 4) treatment options (movement, exercise, pacing and gradual exposure, membrane stabilizer). According to old Mosley papers, no mention of 1) anatomical and patho-anatomical aspects; 2) emotional and 3) behavioral. However in this book, the authors propose that 1) anatomical and patho-anatomical aspects be addressed in PNE with the aim of "de-educating patients" on their erroneous patho-anatomical beliefs; 2) They also propose that PNE address emotional aspects with the aim of helping patients understand why they are suffering (how emotions can trigger, increase or biologically maintain pain); 3) finally they propose that the behavioral aspects be approached such as "moving despite the pain"
Moseley et Butler (2017) [18]	Educational content includes short and long stories, metaphors, diagrams, analogies, literal explanations to explain biological concepts in order to aim for target concepts: 1) broad on pain, neuroscience and anatomy (ex: solidity of the spine, pain is a protector, pain is produced by the brain, pain neuromatrix, pain threshold vs tolerance threshold, Penfield homunculus, biologization of beliefs and thoughts, etc.); 2) tissue changes and nociception (no pain receptor, rarely related pain and injury, tissue scarring, release of acidity related to prolonged positions, peripheral sensitization, etc.); 3) peripheral neuropathic pain (night pains, nerves don't get stuck, ganglia, juice shots aren't injuries, importance of keeping nerves well oiled, etc.); 4) central sensitization (increase in nociceptive volume, sensitivity to light, mirror pain, diffuse pain, etc.); 5) homeostatic systems (stress and homeostatic systems, stress and swelling, virus and pain, etc.; 6) treatment (distraction is analgesic, hugs are analgesic, knowledge is analgesic, music is analgesic, movement lubricates joints, movement is medicine, pain can improve, recovery is done fluctuations, sensitive but not hurt, flares up: avoid them but don't be afraid of them, neuro slips, movement is medicine, gradual exposure, advice on belts & neck braces, manipulations, etc.; 7) diagnostic labels and radiological reports (a vertebra does not move, osteoarthritis reflects aging and not pain, osteophytes are stabilizers, fibromyalgia reflects an overprotective alarm system, etc.). PNE stands out in terms of the content of expectation violation strategies but associates with them to achieve conceptual change.

Theoretical framework and effects - Scientific literature

References	**Specific data** *Must answer the question: "On which theoretical foundations is PNE based?" "How efficacy of PNE is explained?"*
Adenis et al (2020) [17]	PNE increases the patient's adherence to an active rehabilitation program based on a biopsychosocial framework in order to desensitize their protective systems
Agarwal et al (2020) [23]	PNE explains its effectiveness by targeting catastrophism and thus reactivating endogenous inhibitory mechanisms.
Bodes Pardo et al (2018) [54]	PNE desensitizes the nervous system, especially when combined with therapeutic exercise. PNE targets the cognitive-behavioral components of pain, reduces top-down facilitation mechanisms, and encourages the activation of inhibitory mechanisms. A better understanding leads to more appropriate coping strategies, and enhances the effects of therapeutic exercises.
Galan Martin et al (2019) [18]	PNE could change cognitions, catastrophizing, kinesiophobia and avoidance by altering incorrect beliefs. This would consequently enhance adherence to physical activity, which encourages neurogenesis, results in neuroplastic changes in the brainstem and activates descending pathways that inhibit pain. These changes would together enhance quality of life, reduce pain and disability.
Clarke et al (2011) [5]	The underlying theory is that psychosocial factors can be strong predictors of persistent pain and disability (PNE target psychosocial factors)
Dolphens et al (2014) [63]	PNE is part of a neuroscience-based pain treatment that targets central factors (deficit in the descending inhibitory system, central sensitization), psychosocial factors (erroneous beliefs, catastrophizing) and peripheral factors (motor control dysfunction) within a larger biopsychosocial context. PNE specifically targets the enhancement of descending inhibition.
King et al (2018) [48]	In theory, the mechanism of action of PNE is through helping patients better understand their pain, correcting inappropriate beliefs, and reconceptualizing pain. Reconceptualizing pain has the potential to reduce perceived threat. Reducing this perceived threat could potentially: 1) reduce pain-related fear, pain-related distress and disability; 2) break the cycle of misguided problem solving; 3) and potentially reduce pain levels.
Lane et al (2018) [19]	The main mechanism would be pain reconceptualization, including concepts related to fear, knowledge and beliefs about pain. The pain reconceptualization would be a strategy through which therapists could promote self-efficacy, build the therapeutic alliance, and increase intrinsic motivation, thus promoting behavioral changes.
Louw et al (2012) [58]	The proposed mechanism of action is the pain reconceptualization in a way that increases patient confidence and activity levels. This is justified by the fact that studies have shown that maladaptive beliefs are associated with impairments in motor control.
Malfliet et al (2017) [20]	Chronic low back pain is a mixed condition combining peripheral mechanisms (e.g. impaired motor control) and central mechanisms (e.g. central sensitization, psychosocial factors). Therefore, treatment should target peripheral and central mechanisms within a larger biopsychosocial framework. This can be done through the use of PNE followed by an exercise program targeting cognitions
Moseley (2004) [46]	The underlying theory is that reconceptualizing the problem can improve maladaptive beliefs and attitudes. Educational intervention could reduce the levels of catastrophizing, leading to a decrease in vigilance to peripheral nociceptive impulses and a modification of the threshold of sensitivity or tolerance to pain, and thus of the performance on the Laseig test. This decrease in catastrophism could be explained by a modification of the meaning attributed to the nociceptive impulse, which would consequently modify the painful response.
Moseley (2005) [44]	One possible explanation is that the reconceptualization of the problem leads to a change in the belief that pain does not necessarily equate to injury, which in turn leads to increased confidence and increased levels of physical activity. It is highly likely that the change in fMRI during task performance is related to a decrease in perceived threat.
Moseley et al (2004) [47]	The explanatory hypothesis would be the reconceptualization of pain from a reliable indicator of vertebral pathology to the evaluation and adaptation of neural processes. Seen in this way, patients would be more likely to adhere to strategies of exposure to movements and activities that they are afraid of, and would more easily be able to challenge their catastrophic thoughts. PNE would become more clinically relevant when combined with other therapeutic strategies, thus increasing their effects. Another explanatory hypothesis would be that the reconceptualization of pain would reduce catastrophizing, which would have an influence on pain thresholds through a decrease in vigilance towards somatic signals. The authors explain that an education based on a structural model, implying that the underlying structures are vulnerable, would likely increase alertness levels and vigilance towards pain.

Moseley (2003) [45]	One of the hypotheses explaining the effect of PNE would be via the modification of beliefs and attitudes. Another hypothesis would be that modifying the meaning of pain (reconceptualization) would directly modify the intensity of pain, which is biologically plausible. Moreover, patients would be more likely to resume their activities due to feeling less disabled.
Nijs et al (2017) [27]	PNE prepares for cognitive exercise targeted at systemically desensitizing the nervous system.
Nijs et al (2014) [26]	Central sensitization implies that the brain generates more warning signals, including pain, even when there is no tissue damage. Time-contingent treatment, which is favored by PNE, could deactivate downward nociceptive facilitation. This viewpoint is supported by discoveries of decreased central nervous system hyperactivity and increased prefrontal cortical volume in response to time-dependent treatment in patients with chronic pain.
Nijs et al (2011) [31]	When only cognitive and behavioral responses are encouraged, without reconceptualizing pain, these responses can become counter-intuitive because pain is always seen as a sign of injury for them (e.g. education in fear-avoidance model and gradual exposure without reconceptualizing pain). The hypothesis is therefore that by reconceptualizing pain, more appropriate cognitive and behavioral responses will follow as pain will be seen as less dangerous.
Wälti et al (2015) [71]	Various research groups have demonstrated the importance of focusing on the abnormal cortical processing of the central nervous system in patients suffering from chronic low back pain, including cognitive, sensory, and motor disorders. A cognitive approach (PNE) could be beneficial as part of a multimodal treatment.
Werner et al (2010) [57]	PNE is part of the evolution of the vision of low back pain from an injury model to a biopsychosocial model. This view incorporates peripheral and central contributors, and acknowledges that the perception of their problem can influence their thoughts, emotions, and behaviors, which in turn can influence pain, and may determine how to cope with current pain.
Wood et Hendrick (2019) [60]	The purpose of PNE is to desensitize the nervous system
Moseley et Butler (2015) [2]	PNE draws its key principles from psycho-education (particularly conceptual change strategies), health psychology and neuro-immune science related to pain. PNE is based on theories of conceptual change: the questioning of existing knowledge rather than simply learning new information about potentially confronting concepts. Considering a Bayesian perspective, pain can be viewed as a brain output that reflects the most advantageous response based on our brain's probabilistic evaluation. The hypothesis is that the brain is often overprotective due to the perception of an excessive threat to the body, which can be modulated by any credible evidence of danger from nociceptive, somato-sensory, visual, cognitive, auditory, and social modalities. The hypothesis is that PNE alters the perception of threat by altering sensory modalities, such that the brain's response to the situational assessment shifts from “the situation requires protection” (pain) to “does not require protection” (therefore no pain). Numerous clinical studies support that the modification of the perception of the threat linked to a stimulus modifies the symptomatic response (Placebo, Nocebo). Numerous clinical studies support that the modification of the perception of the threat linked to a stimulus, modifies the symptomatic response (placebo, nocebo). These effects have been investigated using fMRI, and several regions of the cerebral cortex (anterior insular cortex and its connections with the periaqueductal gray matter, for example) seem to be involved in this process. Other studies seem to suggest that PNE would stimulate endogenous inhibition compared to control groups.
Moseley (2003) [42]	PNE works by reducing the perceived threat of non-nociceptive signals by enhancing a person's understanding of human physiology. Therapies that focus on nociceptive cues should be implemented in an environment that does not reinforce threatening non-nociceptive cues. Current evidence shows that education has limited effectiveness. The hypothesis is that the content of educational programs is counterintuitive for patients who have a structural biomedical understanding of their pain (pain=injury). PNE addresses this limitation by helping the patient to reconceptualize their pain from a physiological perspective, assuming that appropriate cognitive and behavioral responses will follow. This theory is founded on the principles of deep learning (as opposed to surface learning) which suggests that information that is retained and understood can be applied to current problems. This deep learning is promoted when the participant is motivated and the information is made personally relevant, two factors that are favored by PNE. Thus, the goal of PNE is to reduce the perceived threat and therefore reduce the activity of the pain neuromatrix, as well as reduce its synaptic effectiveness, before introducing a therapy that: 1) targets the components of the neuromatrix pain without fully activating it; 2) increases physical and functional tolerance to threatening sensory and non-sensory stimuli.
Diener et al (2016) [12]	One of the possible explanations for the effectiveness of PNE would be related to the positive manipulation of beliefs and expectations (contextual effects) and their biological impact on the central nervous system.
Wijma et al (2016) [55]	PNE targets cognitions and perceptions that directly contribute to central sensitization, which in turn influence the patient's emotional and behavioural factors. The patient's behaviours are influenced by their perceptions (as explained by the Common Sense Model). The link between these behaviours (avoidance and perseverance) and the persistence of pain is explained by classical and operant conditioning models.

Louw et al (2017) [60]	The nervous system and its plasticity are considered to be a therapeutic target for PNE and other treatments. PNE has been developed to target central sensitization. This hypothesis is supported by clinical trials showing an improvement in local and distant pressure thresholds after PNE. In this context, PNE offers a therapeutic space (decreased nervous sensitivity) for the introduction of a progressive mobilization approach. Another effect of PNE could be related to its ability to foster a therapeutic alliance through shared decision-making strategies.
Moseley (2002) [41]	The legitimacy of PNE was built in opposition to traditional educational approaches (e.g. back-to-school type) that do not target cognitive-behavioral aspects that may represent potential obstacles to recovery and lack of clinical efficacy. PNE is designed to target these cognitive-behavioral aspects through the reconceptualization of the problem.
Louw et al (2017) [51]	The hypothesis explaining the improvement of the SLR would be that education would positively influence muscle tone and blood circulation.
Lotze et Moseley (2015) [40]	PNE stands in opposition to the structural model of pain, which assumes that pain is a reflection of the state of the tissues and only offers treatments that aim to reduce nociception, the results of which have so far been disappointing. PNE is based on the theory that pain is a perceptual inference that elicits protection, and that pain will be modulated by all credible tissue and contextual (endogenous, exogenous, cognitive, emotional, sensory) cues that urge to protection, rather than the condition of the tissues alone, hence its variable relationship. It emphasizes the protective action of pain, and the fact that nociception is neither necessary nor sufficient to produce pain. According to this theory, changing the meaning of pain is likely to change the pain itself. PNE is also based on the theory that chronic pain is linked to maladaptive plasticity of the nervous system, disturbed inhibitory mechanisms and a less precise representation of the body. It is these mechanisms that are targeted by PNE and other associated therapies.
Blickenstaff et Pearson (2016) [38]	Introducing inconsistent cognitive experiences with the “pain does not equal injury” belief has the potential to decrease perceived pain-related threat. Reducing this threat can potentially: 1) help patients consider the influence they have on recovery; 2) change the way they approach movement, exercise and physical activity; 3) thus people are able to repeat movements with greater ease and frequency, creating more positive adaptations. However, for cognitive and behavioral changes to be stronger and more lasting, the generation of mental (PNE) and physical (movement or exercise) experiences is recommended. PNE reduces movement threat, and subsequent repeated movement confirms reduced threat.
Barbari et al (2020) [14]	1) It has been documented that patients with chronic low back pain do not always adhere strictly to exercises, which can affect the outcomes; 2) PNE differs from educational strategies based on a biomedical model, such as those focused on ergonomics, biomechanics like back schools, postural exercises or traditional TM; 3) instead, it is based on a biopsychosocial perspective that is more in line with advances in neuroscience and CLBP research.
Ibrahim et al (2019) [61]	Chronic low back pain is often associated with psychosocial factors such as fear avoidance beliefs, catastrophizing, and negative emotions, which can be addressed by providing educational training.
Nijs et al (2015) [39]	The combination of pain neuroscience education and exercise therapy combined with in vivo exposure principles can desensitize the central nervous system by altering pain memory.

Theoretical framework and effects - Clinician educational resources

References	**Specific data** *Must answer the question: “On which theoretical foundations is PNE based?”; “How efficacy of PNE is explained?”*
Louw et al (2018) [13]	1)What you need to know about the neuroscience of pain ; 2) Traditional and old pain models ; i) Cartesian model of pain ; ii) Take your foot out of the fire; avoid the fire; iii) Put the fire out; iv) Cut the wire (or remove the painful part); 3) Changing beliefs about pain; 4) Input mechanism: Tissues; 5) Input mechanism: Environment; 6) Input mechanisms: Peripheral neurogenic; i) Ions channels; ii) Double crush and axoplasmic flow; iii) Blood flow; 7) Processing mechanism: Spinal cord, dorsal horn and second-order neurons; 8) Processing mechanism: Brain, the pain neuromatrix and functional changes in the brain; 9) Processing mechanism: The pain neuromatrix, yellow flags and “personalization” of the pain experience; 10) Output mechanisms: The stress response, endocrine system and immune system; i) Stress response; ii) Clinical manifestation of the output systems; 11) Plasticity and merging of systems.
Moseley et Butler (2017) [18]	1) You and your sneaky theories i) theory : a system of ideas intended to explain something ; ii) The biopsychosocial model of pain ; iii) Theory One : The Grand Poobah Pain Theory (GPPT) ; iv) Theory Two : Neurotags, collaboration and competition ; v) Theory Three: The cortical body matrix theory ; 2)

	Supercharge your pain biology ; i) The relationship between damage, nociception and pain ; ii) Detecting tissue based events ; iii) A new look at primary nociception ; iv) What makes primary nociceptors fire? ; v) Two way traffic – efferent function of nociceptors; vi) Time for neuroimmune coupon – hang on to your haats! ; vii) The immune set point, TLR4 and why you should care; viii) The dorsal horn: time for a rethink; ix) Central sensitization; x) Smudging neurotags; xi) The grand finale – a pain mechanisms sheet.

Practical aspects - Scientific literature

References	**Specific data** *Must answer the question: "PNE is delivered individually or in a group?"; "How long is a PNE session?"; "How many PNE sessions are delivered?"; "Over what period of time is PNE delivered?"*
Adenis et al (2020) [17]	Evaluation and synthesis stage (30 minutes) will be conducted individually, following the 4 hours of educational intervention spread over 4 days, consisting of 2 sessions of 30 minutes per day conducted in group.
Agarwal et al (2020) [23]	There were 7 appointments over a 9-month period. Each session included PNE among other things (exam, consultation, home exercise). Each session lasts between 25 and 45 minutes.
Anandkumar et al (2017) [24]	For patient A, the first 2 sessions consisted of individual PNE of 50 minutes each. For patient B, the first 2 sessions consisted of individual PNE of approximately 30 minutes each.
Bodes Pardo et al (2018) [54]	Two educational group sessions (4 to 6 participants) of 30 to 50 minutes, with the second session taking place one month after the first.
Clarke et al (2011) [5]	2.5 - 4 hours of individual or group instruction. PNE can be provided in one or more sessions.
Dolphens et al (2014) [63]	The first three sessions are educational. These are individual educational sessions lasting approximately thirty minutes, with the exception of session one (a one hour group session with six participants per group), and session two (online).
Gallan Martin et al (2019) [53]	Six group PNE sessions (10 hours) were held. The first four sessions lasted 1.5 hours twice a week. A final session of two hours was held to reinforce the major concepts of the program, plus an educational book. A review session after three months emphasized doubts and problem solving.
King et al (2018) [48]	All participants received PNE as part of their usual NHS care. PNE session was delivered for a group of 10-12 people
Louw et al (2012) [58]	PNE was delivered in a private room for 45 minutes, within the first 75 minutes of the initial history and physical examination session. This initial session was followed by 7 physiotherapy sessions which included PNE, as well as other treatment strategies.
Malfliet et al (2017) [20]	Combination of a one group session (6 people per group) , one group online session and one individual session (profitability argument) supplemented by an information brochure to be read at home.
Mansouri et al (2018) [73]	Pamphlet to be read within 3 weeks.
Moseley (2004) [46]	One individual PNE session (face-to-face) of three hours.
Moseley (2005) [44]	One individual session of two and a half hours.
Moseley et al (2004) [47]	1 individual 3-hour PNE session with a 20-minute break
Moseley (2003) [45]	4 individual sessions of 1 hour spread over 2 weeks or 1 group session of 4 hours (7 to 10 patients)
Nijs et al (2014) [26]	Two to three individual sessions spread across two weeks.
Nijs et al (2011) [31]	Two PNE sessions (approximately 30 minutes depending on the evolution of cognitions) individually (face-to-face).

O'Keeffe et al (2015) [69]	Six PNE group sessions over six to eight weeks in groups of up to ten participants. Group sessions last an hour and fifteen minutes (PNE + exercises) with the PNE part lasting thirty minutes per session.
Orhan et al (2019) [28]	Two individual PNE sessions conducted one week apart. The first session lasted between 45 to 60 minutes. The second session lasted 45 minutes.
Pires et al (2015) [53	It took place in an outpatient clinic. PNE consisted of 2 group sessions of 90 minutes each.
Rizzo et al (2018) [67]	PNE was delivered in groups ranging from 1 to 7, twice a week, for 4 weeks
Rufa et al (2018) [31]	There were two semi-standardized individual face-to-face PNE sessions with a two-week interval. Session 1 lasted for sixty minutes, and Session 2 for thirty minutes.
Ryan et al (2010) [68]	Intervention lasting 2 hours and 30 minutes.
Saracoglu et al (2020) [32]	Four PNE sessions were held once a week, individually (face to face) for approximately 40-50 minutes.
Saracoglu et al (2020) [33]	In addition to manual therapy sessions, patients received PNE once a week for 4 weeks individually (face to face) lasting 45 to 50 minutes
Tegner et al (2018) [65]	PNE take different formats ranging from intensive one-on-one sessions, to small group sessions, and large seminars of up to 3 hours. The greatest effect is seen when the sessions were individual and intensive (not surprising given the complexity and individual nature of the pain).
Tellez-Garcia et al (2015) [49]	30-minute individual PNE sessions, once a week for 2 weeks after dry needling application
Toomey et al (2020) [34]	12 sessions targeting PNE, manual therapy and exercises.
Unhal et al (2020) [70]	PNE is delivered in 40 minute sessions twice a week for 8 weeks
Vier et al (2018) [70]	There are sessions twice a week for 6 weeks individually
Wälti et al (2015) [71]	There are between 2 and 4 education sessions.
Werner et al (2010) [57]	The intervention is delivered in the form of 4 sessions of 30 minutes, with one session per week. Each session include specific educational content and one-on-one discussion between the patient and healthcare professional.
Wood et Hendrick (2019) [60]	PNE is delivered in many formats: from one-on-one sessions, to webinars, to group sessions.
Moseley et Butler (2015) [2]	PNE takes several formats: intensive individual sessions, sessions in small groups, or large seminars up to three hours long.
Louw et al (2016) [36]	PNE can be given in 10-15 minutes during the first 50-minute individual physiotherapy session (including anamnesis, physical examination and therapy), and then 10 minutes per session during the following 30-minute sessions.
Moseley (2003) [42]	Education can take time. It can be done individually or in a small group.
Moseley et al (2002) [20]	One hour of individual face-to-face educational session, once a week, for four weeks, plus a small workbook.
Louw et al (2017) [51]	Duration of 5 minutes.
Lotze et Moseley (2015) [40]	Several formats: 1) Face-to-face; 2) Small groups; 3) Large groups. Duration up to 3 hours. Approach adapted to preferences and financial considerations.
Blickenstaff et Pearson (2016) [38]	Some data suggest that individual PNE gives better results than PNE delivered in small groups
Barbari et al (2020) [14]	Individually or in a group, 1 to 8 sessions, 30 minutes to 3 hour session, generally once a week for multiple sessions.
Ibrahim et al (2018) [56]	Group sessions of 3 to 5 participants. Sessions begin with 15-20 minutes of interactive discussion followed by a 1-hour lecture.

Ibrahim et al (2019) [61]	Group sessions of 3 to 5 participants. Sessions begin with 15-20 minutes of interactive discussion followed by a 1-hour lecture.
Galan-Martin et al (2020) [25]	Patients assigned to the experimental group will perform a PNE program consisting of six sessions (10 hours) and eighteen sessions of therapeutic physical exercise to be performed in six weeks (18 hours), with a frequency of three sessions per week.

Practical aspects - Clinician educational resources

References	**Specific data** *Must answer the question: "PNE is delivered individually or in a group?"; "How long is a PNE session?"; "How many PNE sessions are delivered?"; "Over what period of time is PNE delivered?"*
Louw et al (2018) [13]	The timing and frequency of PNE sessions vary depending on the study. They can last anywhere from 30 minutes to 4 hours. Frequency can range from 1 single session to several sessions over the course of treatment. The most common way of delivering PNE is face-to-face verbal format (individual), but some studies have also looked at PNE in groups, using only educational booklets, or remotely (telecare, e-learning, e-mail). The choice of individual, group, or remote format could be based on the risk of chronicity.
Moseley et Butler (2017) [18]	1) Example of PNE Group: 8 sessions of 2 hours spread over 6 weeks for a group of 12 in a conference room; 2) Example of Individual PNE: 8 sessions of 30 minutes (including gradual exposure and functional restoration) in the outpatient clinic of a hospital.

Learning modalities - Scientific literature

Reference	**Specific data** *Must answer the question: "What learning strategies, methods and supports were used?"*
Adenis et al (2020) [17]	Educational content is presented with the use of simple explanations, pictures and metaphors.
Agarwal et al (2020) [23]	Educational content was presented with th use of examples, metaphors, and images to facilitate learning about the biology of pain was explored. Several formats such as verbal discussion, YouTube video, educational cards (e.g. 'Why do I hurt?'), and additional educational materials (figures and concepts from Supercharged EP) were used. Educational material was provided to the patient at each session for them to reflect upon, and to allow for further discussion during each visit. Visual aids (e.g. spine models, drawings, flowcharts, and metaphors) were used during PNE sessions.
Anandkumar et al (2018) [24]	Educational content is mainly based on the book Explain Pain, including an individualized curriculum based on the main concerns of patients, is used during PNE sessions. Visual aids such as drawings, images, metaphors, flowcharts, PowerPoint presentations, YouTube videos, and animations are also used.
Bodes Pardo et al (2018) [54]	Educational content is based on the books Explain Pain and Pain In Motion. A small booklet is given out at the end of the sessions to reinforce key concepts.
Clarke et al (2011) [5]	Various models are presented to the patient using simple pictures and metaphors to explain the complex neurophysiology of pain.
Dolphens et al (2014) [63]	Educational content is presented verbally (therapist's explanations) and visually (summaries, pictures and computer diagrams). Following each session, patients are given a handout summarizing the educational content provided, and are asked to read it thoroughly. Content and pictures are based on the Explain Pain educational book.
Gallan Martin et al (2019) [52]	Educational books are given to participants. Reinforcement sessions with answers to questions and problem-solving are proposed.
Louw et al (2012) [58]	Educational content is accompanied by pictures, anecdotes and metaphors
Malfliet et al (2019) [22]	Educational content must be delivered with a strong interaction between the patient and the therapist (focusing on effective communication rather than one-sided lecturing).

Malfliet et al (2017) [20]	Examples and metaphors are used based on participants' experiences. Participants were invited to read the information brochure at home between the group and individual sessions. The online session builds on the content of the group session to facilitate a deeper understanding and assessment of knowledge and representations. The information gathered was used to tailor the 3rd session (individual) and Pain Neurophysiology Questionnaire as part of the program to further explore misconceptions and misunderstandings.
Mansouri et al (2018) [73]	The content of the booklet is adapted to the patient's understanding: comprehensive, simple, enjoyable, without imposing time constraints or complexity.
Moseley (2004) [46]	Educational content is presented with hand-drawn drawings and images accompanied by interactive commentary. There were no problem-solving exercises, coping strategies, or role-playing exercises, but examples were used to illustrate the concepts.
Moseley (2005) [44]	Educational content is presented with the use of pictures, examples and metaphors
Moseley et al (2004) [47]	During the educational sessions, people were free to sit, stand, or walk. There were no problem-solving exercises, coping skills training, or role-playing. Diagrams and examples were used to convey the concepts. At the end of the session, each participant received a workbook consisting of 10 sections. Participants were advised to read one section, then answer three questions about the material in it.
Nijs et al (2017) [27]	An information brochure, explanatory manual (e.g. Explain Pain) and website (e.g. Retrain Pain) designed specifically to explain pain to people with persistent pain are used during the PNE sessions.
Nijs et al (2014) [26]	Illustrations, examples and metaphors should be used frequently when delivering educational content to patients. Messages should be tailored to the level of intellectual ability and literacy of the patient.
Nijs et al (2011) [31]	Using a booklet with written recommendations is recommended. Illustrations, examples, and metaphors are often used when delivering educational content to patients. The educational content is presented verbally (explanations by the therapist) and visually (summary, images, and diagrams presented on computer or paper). During sessions, patients are encouraged to ask questions and their input should be utilized to personalize the information.
O'Keeffe et al (2014) [69]	Participants have the opportunity to ask questions. Visual aids are used (PowerPoint, Flipchart) and a copy of the slides is given to the participants. In addition, all participants are invited to read resources on the internet (pain-ed) and will receive brochures on sleep, relaxation, imagery and physical activity
Orhan et al (2019) [28]	The content is supplemented with visual aids such as images, drawings, graphics and metaphors. Patients receive a home education leaflet and are asked to read it several times and write down any questions they have before the second session. The patients return to discuss their questions and the researchers ensure that everything was understood. Use of PowerPoint "Pain in Motion" support slides was discussed with the patient.
Pires et al (2015) [53]	Educational content is presented with the use of pictures and metaphors.
Rizzo et al (2018) [67]	Participants are encouraged to ask questions. At the end of each session, the information is summarized and a workbook is provided containing the same content as during the lessons. Each participant is invited to review the material after each lesson.
Rufa et al (2018) [31]	Participants receive a booklet (Why Do I Hurt) to reinforce the content seen in the first session and are invited to read it before the next session.
Ryan et al (2010) [68]	Educational content is delivered using verbal communication, prepared diagrams and freehand drawings. In addition, all participants received a "Back Book"
Saracoglu et al (2020) [32]	Educational content is presented with the use of metaphors, anecdotes, and pictures utilizing PowerPoint.
Saracoglu et al (2020) [33]	To facilitate the transmission of concepts, metaphors, anecdotes, graphics, pictures, disseminated using a PowerPoint, were used.
Tegner et al (2018) [6]	The systematic review includes only verbal PNE, but educational content can be delivered through videos, books and pamphlets.
Tellez-garcia et al (2015) [49]	A PowerPoint presentation based on the Explain Pain educational book is used to facilitate understanding of the concepts. During the sessions, patients are encouraged to ask questions and their input is used to individualize the information they received. Written information on the pain physiology concepts discussed during the sessions is provided as homework between sessions.
Toomey et al (2020) [34]	Resources used are: YouTube video (ex: Taming the beast, understanding pain in less than 5 minutes, TEDx why things hurt, etc.), educational books (ex: Painful Yarns, explaining pain), analogies (ex: the system fire alarm) education

Unal et al (2020) [35]	Educational content is presented with the used of simple pictures, examples, booklets, metaphors. A workbook (with questions / answers) is also used.
Van Wilgem et Keizer (2012) [59]	The concept of sensitization is best explained with a metaphor (e.g. alarm system). If possible, the metaphor should correspond to the patient (e.g.: in connection with his work, his hobbies).
Wälti et al (2015) [71]	Participants received a copy of the Explain Pain educational book. During the first 2 weeks, participants have to read ten pages of the book each day, and answer a questionnaire about the content.
Wood et Hendrick (2019) [60]	Individual explanations with the use of booklets and books to supplement the explanations.
Moseley et Butler (2015) [2]	PNE draws on conceptual change theory, instructional design and multimedia principles to explain the biology of pain. There are booklets and educational books available for patients.
Louw et al (2016) [36]	PNE works best using pictures, examples, and metaphors to promote deep learning.
Moseley (2003) [42]	1) For patients to understand the educational material, it is necessary to use graphics (including whiteboards, hand drawings, and personalized manuals) and metaphors. 2) Deep reconceptualization is facilitated when: a) the learner is motivated; b) the information presented is relevant to them.
Louw et al (2017) [60]	PNE is best delivered with metaphors, examples, and images. For example, the alarm system metaphor can be used to explain central sensitization.
Moseley et al (2002) [20]	A small book is used.
Louw et al (2017) [51]	Verbal explanations and pictures are used.
Barbari et al (2020) [14]	1) Use of leaflets/booklets to reinforce the understanding of concepts; 2) Use of diagrams, examples, metaphors to facilitate learning; 3) Use of media such as books, booklets, PowerPoint presentations.
Ibrahim et al (2019) [61]	Verbal education with visual aids such as prepared slides and diagrams, as well as simple cultural metaphors to reinforce certain information.
Ibrahim et al (2018) [56]	An interactive session/discussion is followed by a lecture. Other: 1) visual aids (diagrams, slides); 2) simple and cultural metaphors to reinforce certain information; 3) simple and clear information in simple language to accommodate the participants' low levels of literacy and cultural understanding.
Nijs et al (2015) [39]	Educational content is provided using a Socratic style education and associative learning (violation of expectations). An educational booklet is also used.
Galan-Martin (2020) [58]	1) Active listening; 2) Metaphors and visuals used; 3) Ensuring that the information is well understood; 4) Empathy; 5) Sending positive messages; 6) Resources, infographics, and video; 7) Stimulating nature of the group; 8) Individualized educational content.

Learning modalities - Clinician educational resources

References	**Specific data** *Must answer the question: "What learning strategies, methods and supports were used?"*
Louw et al (2018) [13]	Educational content is not presented in a lecture format, but rather designed as conversations where the person is encouraged to ask questions so that the educational material can be personalized. The use of stories, metaphors and examples helps to make the understanding of complex information such as the neurobiology of pain easier. The authors also believe they have the power to alleviate fears and promote behavior change. The use of visual resources can help promote understanding, retention and use of PNE (as humans are visually oriented). There are many educational resources available to provide educational content: patient books, educational cards, posters, workbooks, etc. There is also the possibility of moving away from commercial educational tools and creating your own tools (e.g. drawings) to further individualize education. The PNE approach promotes the active participation of the patient by proposing cognitive homework to reinforce the concepts that have been discussed.
Moseley et Butler (2017) [18]	1) Metaphor provides an opening to understand the patient's world; 2) Listening to the patient's metaphors, and offering back metaphors combined with transformative literal explanations (DIM->SIM) can be a respectful way to challenge unhelpful conceptions; 3) Quotations can be helpful, some learners love it;

	4) Treating chronic pain can be a long journey, some metaphors related to perseverance and pacing can be helpful in keeping the person on board. 5) Importance of taking into account the strength, coherence and acceptance of a concept; 6) Importance of taking into account the motivation for change; 7) favoring the position of cognitive guide because it favors the reconceptualization of pain, rather than in a masterful way or by conditioning; 8) the message must be persuasive: understandable, plausible, coherent and attractive; 9) books alone are not enough; 10) PNE uses multimedia principles with a combination of words (printed or spoken) and pictures (illustrations, photos, animations, video); 11) use SIMs and non-DIMs pictures; 12) adapt according to the context

Associated treatment - Scientific literature

References	**Specific data** *Must answer the question: "PNE is delivered alone or with other treatments? Which one?"*
Adenis et al (2020) [17]	PNE is associated with multimodal and multidisciplinary treatment (balneotherapy, physiotherapy, ergonomics of the spine, stretching, muscle strengthening, relaxation, podiatry and speaking time).
Agarwal et al (2020) [23]	PNE is associated with opioid tapering
Anandkumar et al (2018) [24]	Mindfulness, breathing, quota-based reduction in exercises and modification of exercises into social activities, pleasurable activities, and hobbies.
Bodes Pardo et al (2018) [54]	The therapeutic exercise program was a multimodal exercise program that included motor control exercises for the lumbar spine, stretches and aerobic exercises
Clarke et al (2011) [5]	PNE alone or combined with treatment (physiotherapy, pain management program, motor control exercises).
Dolphens et al (2014) [63]	PNE is associated with exercise therapy with particular emphasis on motor control, time-contingent and cognition-focused. A home exercise program is established for each patient (with modalities described verbally and visually), who is strongly encouraged to continue during the 1-year follow-up.
Gallan Martin et al (2019) [53]	PNE is associated with group physical exercise, playful, dual task and promoting socialization. Tasks and challenges are carried out at home.
King et al (2018) [48]	PNE alone
Lane et al (2018) [19]	PNE is associated with current therapeutic approaches such as manual therapy and exercises.
Louw et al (2012) [58]	PNE is followed by a graded exercise/exposure approach such as Cognitive Behavioral Therapy (CBT). Therapies include cardiovascular exercise, neural mobilization exercises, spinal mobilization and stretching exercises, strengthening exercises, balneotherapy, hot physiotherapy during which the patient must focus on breathing, relaxation, summarizing the time, reflecting on goals and progress, and a home exercise program.
Malfliet et al (2019) [22]	PNE can be applied with other physical therapy interventions such as activity therapy, exercise therapy or manual therapy
Malfliet et al (2017) [20]	PNE is associated with motor control focused on cognitive processes and functional dynamic exercises.
Mansouri et al (2018) [73]	PNE is associated with a rehabilitation program
Moseley (2004) [46]	PNE alone
Moseley (2005) [44]	PNE alone
Moseley et al (2004) [47]	PNE alone
Moseley (2003) [45]	PNE is delivered with structured therapeutic exercises on motor control and home exercises. The motor control program is limited to a few variations to take into account the specificities of the PNE educational model: 1) no requirement for the position of activation of the trunk muscles, each patient has to choose the position where he feel most at home. ugly ; 2) progression implies an intermediate stage of motor imagery; 3) the exhibition focuses on movements and activities involving fear; 4) the final stages of progression involve training in conditions of cognitive or psychosocial stress.

Nijs et al (2017) [27]	PNE prepares for the cognitions-centered exercise. It may be associated with the normalization of ill-adapted provocative posture and movement patterns + CBT-I (change in negative thoughts about sleep, sleep restriction therapy, and learning relaxation techniques)
Nijs et al (2014) [26]	Cognition-centered exercise divided into 2 stages: 1) motor control exercise, 2) functional exercises. Motor control exercises can be preceded by motor imagery exercises. The progression is gradual
Nijs et al (2011) [31]	Often followed by various components of a biopsychosocial oriented rehabilitation program, such as stress management, gradual activity and exercise therapy
O'Keeffe et al (2015) [69]	PNE is associated with progressive exercise circuits including aerobic, flexibility and strengthening exercises + a relaxation component at the end of each class
Orhan et al (2019) [28]	PNE alone
Petersen et al (2019) [29]	PNE is integrated with targeted therapeutic exercises
Pires et al (2015) [53]	PNE is associated with a group balneotherapy
Puentedura et Louw, (2016) [30]	Hands-on therapies may initially seem more appropriate for use in conjunction with PNE, however this article outlines how hand-on therapy (manual therapy) could potentially be associated with PNE and supervised exercise / movement.
Rizzo et al (2018) [67]	PNE is associated with hypnosis
Rufa et al (2018) [31]	PNE alone
Ryan et al (2010) [68]	PNE is associated with training circuits based on graduated aerobic exercises and some core / stabilization exercises.
Saracoglu et al (2020) [32]	PNE is associated with individualized manual therapy based on the patient's response to treatment, as well as a group exercise program that begins with lumbar and pelvic warm-ups and stretching, followed by strengthening exercises. The goal of the program is to improve the strength and flexibility of the erector spinae muscles, abdominals, hamstrings and quadriceps.
Saracoglu et al (2020) [33]	PNE is combined with manual therapy with a patient-centered model adapting techniques according to the patient's response.
Tegner et al (2018) [6]	PNE can be given alone or in combination with other treatment modalities (e.g. physiotherapy, CBT, manual therapy)
Tellez-Garcia et al (2015) [49]	PNE is associated with 3 dry-needling therapy sessions on active TrP .
Toomey et al (2020) [34]	PNE is associated with a multimodal approach based on the biopsychosocial model based on manual therapy and exercises.
Unal et al (2020) [35]	PNE alone
Van Wilgem et Keizer (2012) [59]	PNE is associated with a multidisciplinary program.
Vier et al (2018) [70]	PNE is associated with a lumbar manipulation (grade V).
Wälti et al (2015) [71]	PNE is associated with sensory retraining and motor retraining.
Werner et al (2010) [57]	PNE is delivered in addition to their normal treatment.
Wood et al (2019) [60]	PNE can be given alone or in combination with other forms of physiotherapy treatment such as exercise, manual therapy, dry needling, or acupuncture.
Moseley et Butler (2015) [2]	PNE promotes biopsychosocial care, including, but not limited to, multimodal reactivation based on Cognitive Behavioral Therapies. PNE integrates treatment of peripheral and central contributors to pain. PNE can promote strategies promoting neuroplasticity (or the stimulation of endogenous analgesic substances) such as pharmacological means, hypnosis, meditation, or exercise.
Louw et al (2016) [36]	To desensitize the nervous system, PNE is combined with aerobic exercise, relaxation, meditation, manual therapy (joint mobilization, soft tissue treatment, neurodynamics, stretching, etc.), diaphragmatic relaxation, goal setting, sleep hygiene, and so forth.

Moseley (2003) [42]	Graded motor and functional tasks, of insufficient intensity to activate the pain neuromatrix, sufficient to selectively activate components of this neuromatrix, and whose progression is effected by increasing the threat (sensory or non-sensory), making it possible to desensitize the neuromatrix
Louw et al (2017) [60]	PNE combined with manual therapy reinforces the message of manual therapy (contingent non-symptom approach)
Moseley (2002) [41]	Manual therapy (spinal mobilization / manipulation, massage, muscle and neurodynamic techniques) + motor control exercise + home exercises
Louw et al (2017) [51]	Grade II manual therapy technique
Lotze et Moseley (2015) [40]	Graded Motor Imagery
Blickenstaff et Pearson (2016) [38]	PNE associated with movement and exercise (e.g. gradual exposure technique), in order to increase the effectiveness of these approaches and reinforce the educational message of PNE
Barbari et al (2020) [14]	1) PNE alone; 2) PNE associated with: i) therapeutic exercises; ii) balneotherapy; iii) dry needling; iv) sensory retraining; v) motor retraining (from motor imagery to functional activity; vi) Cognitive Functional Therapy (normalization of postures and behaviors, integration of these standardized patterns into activities of daily living, physical activity program based on patient preferences and impairments).
Ibrahim et al (2019) [61]	PNE is followed by motor control exercise, stretching and aerobic exercises.
Ibrahim et al (2018) [56]	PNE is followed by motor control exercise, stretching and aerobic exercises.
Nijs et al (2015) [39]	PNE is associated with exercise therapy based on in vivo exposure principles (e.g. motor control training, aerobic training or muscle strengthening).
Galan-Martin et al (2020) [25]	PNE is associated with therapeutic physical exercise

Associated treatment - Clinician educational resources

References	**Specific data** *Must answer the question: "PNE is delivered alone or with other treatments? Which one?"*
Louw et al (2018) [13]	PNE must be integrated with a physical treatment (PNE Plus) as it yields better results than PNE alone. The treatment (PNE Plus) can involve different strategies that can be tailored according to the patient's needs and the clinician's training. A set of pharmalogical and non-pharmalogical strategies, hands-off and hands-on, cognitive, behavioural therapy, etc. can be used (offering a total of 36 treatment options). However, according to evidence-based approaches and pain sciences, the key elements of a PNE+ program are: 1) PNE; 2) aerobic exercise; 3) sleep hygiene; 4) goal setting; 5) relaxation; and 6) education.
Moseley et Butler (2017) [18]	To achieve clinically significant results, PNE is combined with other treatments supported by an evidence-based biopsychosocial framework. PNE interconnects, combines and applies components of other evidence-based approaches such as motor imagery, gradual exercise, Pilates, yoga, taichi, hypnosis and psychological techniques, pharmacology and surgery, among others.

Clinical posture - Scientific literature

References	**Specific data** *Must answer the question: "In what mindset or attitude is PNE delivered?"*
Anandkumar et al (2018) [24]	Clinicians pay attention to the choice of words and explanatory models (avoiding anatomical and patho-anatomical models) due to their limited effectiveness and the potential for negative impacts (nocebo effect).
Galan Martin et al (2019) [18]	Aware of inhibitory system dysfunction, the exercises will not be symptom contingent and function-centered.

Louw et al (2012) [58]	A manual approach was purposefully excluded because it would contradict PNE: de-emphasizing tissues and focusing on sensitizing the central nervous system.
Malfliet et al (2019) [22]	1) PNE must be delivered with a strong interaction between the patient and the therapist (communication rather than one-sided lecture); 2) if the therapist combines PNE with passive strategies, the communication must be adapted to a biopsychosocial (rather than biomedical) framework. Example: prefer the terms desensitize (bps) rather than restore (biomedical). Choose less threatening and more neutral words (e.g. symptoms rather than pain)
Malfliet et al (2017) [20]	A strong therapeutic alliance is necessary to achieve clinical outcomes for pain.
Nijs et al (2017) [27]	The physical therapist must take into account the thoughts of the person, and extend the reconceptualization of pain to exercise and daily activities
Nijs et al (2014) [26]	More than an educational framework is needed: the term “neuroscience communication of pain” is applicable here. Such communication can pave the way for behavior change (including exercise therapy)
Van Wilgem et Keizer (2012) [59]	PNE is delivered according to a biopsychosocial approach to integrate physical, psychological, behavioral and environmental factors to understand why sensitization persists, and to promote their identification
Moseley et Butler (2015) [2]	One of the fundamental principles of PNE is that pain is a truly biopsychosocial phenomenon, where nociception and pain are 2 distinct entities, distinguishing themselves from structural biomedical models (nociception = pain).
Louw et al (2016) [36]	A successful and adapted PNE must match the complexity of the person's painful experience. This requires the development of a therapeutic alliance with the person so that they have confidence, and to take into account a certain timing. Education must be an active, adapted and quantified process. Trust and the therapeutic alliance are critical components of PNE, and develop throughout the interview and the clinical examination: the patient must feel heard and examined conscientiously, without using fear-inducing words (nocebo), without focusing the examination on irrelevant details (e.g. tilting of the pelvis) and to be explained in a clear and reassuring manner the results of the examination (placebo). For PNE to work, images, language and explanations that refer to an anxiety-provoking patho-anatomical model should be eliminated, and a language of PNE should be encouraged. PNE-integrated care has many nuances that should not be overlooked, which are rooted in cognitive, motivational, educational domains and various principles of psychology, rather than just PNE. PNE promotes patient empowerment so that they become an actor in their care. PNE not only educates people about pain, but also deconstructs powerful biomedical models that have been shown to have limited efficacy but are likely to undermine the trust of patients in the medical field. PNE also deals with various psychological issues related to pain. Furthermore, it combines the psychological, biological and physiological dimensions of pain treatment to offer a biopsychosocial approach to treating people in pain. This requires spending time with the patient, engaging in meaningful conversations and providing physical support, all of which have been highly valued by patients receiving pain treatment.
Moseley (2003) [42]	1) To be effective: the therapist must be perceived as i) an expert; ii) respectful and compassionate; 2) Information should be presented in a respectful manner that acknowledges the patient's suffering.
Diener et al (2016) [12]	1) An in-depth interview that embraces a biopsychosocial perspective can be a key first step in a successful PNE; 2) The importance of in-depth interviewing through the use of specific communication strategies (active and reflective listening) in order to i) explore patient-specific beliefs and risk factors that will become targets for PNE; ii) promote collaborative decision-making, improve patient participation and engagement in problem solving, and confidence in making autonomous decisions; 3) The importance of healthcare influence on patient's beliefs and attitudes and emotional power of words: i) messages increasing threat value can increase alertness, fear, guilt, frustration and therefore pain; ii) reassuring, confidence-building messages and helpful advice can positively influence movement and activity; 4) The need to explain the results of the examination to reduce the threat and empower the patient to make decisions.
Wijma et al (2016) [55]	A biopsychosocial assessment allows an interactive and person-centered PNE
Louw et al (2017) [60]	A combination of PNE and manual therapy reinforces the message of PNE (pain can change independently of tissues) only if there is a shift in communication: 1) a focus on function rather than symptom resolution is employed; 2) the strategy is presented as a transitional therapy.
Lotze et Moseley (2015) [40]	1) The importance of message consistency; 2) unifying principle is to provide evidence of safety (reassurance, education, therapeutic alliance): interaction, be caring, take the time, focus on the patient's needs, show that you are informed, explain the pain, explain approaching rehabilitation with simple words provides evidence of safety; 3) cognitive principles: i) rehabilitation should be load- or time-dependent (not pain-dependent); ii) when the pain increases or after the treatment, it is not a symptom of damage, but the sign of an overprotective alarm system; iii) balance between empathy and the need to hold the line to desensitize the nervous system; iv) remind the patient that he is responsible for his body and his rehabilitation; v) lead him to pay attention to the healthy aspects

	of his body; vi) incorporate exercises at home; vii) teaching the patient to identify sources of safety; viii) learn and implement coping strategies to relieve pain; ix) give the patient the resources to control the situation and achieve his achievable goals; x) and help her understand the principles of slow and steady progression based on a modern understanding of her pain.
Blieckenstaff et Pearson (2016) [32]	1) Need for exercise prescription and instructions to be consistent with PNE messages (e.g. not to associate PNE with a contingent symptom approach); 2) For reconceptualization to occur, exploration and experimentation must occur at cognitive (PNE) and physical (gradual exposure) levels: PNE decreases threat to movement, and exposure confirms or refutes this new belief necessary for lasting change.

Clinical posture - Clinician educational resources

References	Specific data *Must answer the question: "In what mindset or clinical attitude, PNE is delivered?"*
Louw et al (2018) [13]	1) Importance of mastering the sciences of pain; 2) the spirit is to plant PNE seeds and water them with compassion; 3) focus on function rather than pain; 4) set limits; 5) all pain is real; 6) movement is the greatest pain reliever in the world; 7) each patient has a brain, and each brain is attached to a person; 8) the therapeutic alliance is a first fundamental step in PNE and essential and fundamental for the success of PNE; 9) the therapeutic alliance requires specific communication (need to be present, receptive, authentic and engaged) and a safe, welcoming, healing context 10) Need to soften words and use less provocative language (sensitive rather than pain for example)
Moseley et Butler (2017) [18]	1) PNE requires a biopsychosocial mental framework; 2) broadly speaking, PNE can be a way of reasoning about pain based on concepts from the pain sciences; 3) pay attention to your language: avoid structural metaphors and DIMs, favor SIMs; 4) the appropriate use of humor aids (SIMs); 5) the educator as a cognitive guide, rather than a teacher or learning through conditioning; 6) no ageism (age does not equal decline).

Patient educational resources

References	**Content**
0	*Must answer the question: "what does PNE contain?"*
Pain In Motion [63]	The booklet employs simplified literal information, analogies, metaphors, and diagrams to facilitate the transmission of biological concepts related to chronic pain, the distinction between pain and injury, and the contribution of biopsychosocial factors to the maintenance of the problem. Specifically, it covers: 1) the description of nociceptive pathways (nociceptors, ion channels, neurons, action potential, nociception, synapses, inhibitory and facilitating chemicals, spinal cord, descending pro and anti-nociceptive pathways) and pain (the role of the brain); 2) the process of acute pain becoming chronic (central nervous system sensitization at the spinal level); 3) the manifestations of central nervous system sensitization (pain can move, appear in different locations, and be disproportionate after tissue healing); 4) factors that may account for central nervous system sensitization (stress, anxiety, negative thoughts and emotions, physical deconditioning, avoidance behavior, conflicts); 5) the ability of the nervous system to desensitize; and 6) recommendations for desensitizing the nervous system (understanding pain to overcome fear, identifying triggers, engaging in distraction activities, pacing, exercise and gradual activity, cognitive therapy, relaxation techniques).
Retrain Pain Foundation [65]	This educational tool utilizes concise PowerPoint slides, incorporating images, minimal text, metaphors, analogies, simplified literal explanations, and general concepts to facilitate the understanding of biological concepts (pain not necessarily indicating injury, pain context-dependent, perceived threat affects pain, chronic pain correlates with nervous system sensitization, biopsychosocial factors may sustain pain, chronic pain can improve). Specifically, the tool covers: 1) nociceptive pathways and pain; 2) peripheral sensitization; 3) central sensitization; 4) descending pro and anti-nociceptive pathways; 5) the influence of downward modulation on pain and the nervous system; 6) pain and modulation being dependent on the brain's perceived threat; 7) factors that may contribute to nervous system sensitization (beliefs, negative thoughts and emotions, hyper-focus, sleep, opioids); and 8) recommendations to facilitate nervous system desensitization (pain understanding, mindfulness meditation, sleep hygiene, appropriate medication).

Louw and al (2015) [10]	Introduction: Role of the book: 1) how pain works and 2) provide strategies to reduce pain. Section 1 helps to understand the difference between pain and disability; Section 2 provides an understanding of imaging and physical testing. Section 3 seeks to deconstruct beliefs about back pain: 1) deconstruction of patho-anatomical beliefs (osteoarthritis equals pain, pain equals injury), pathomechanical (hyper lordosis, hyper kyphosis, postures, MI inequalities, lack of strength, and lack of flexibility) and treatment (rest, medication, losing weight, etc.) + promoting strong spinal tissues. Section 4: helps to understand 1) why the pain persists (alarm system remains hypersensitive beyond the tissue healing time linked to the presence of stressors)? ; 2) What does sensitization of the nervous system look like clinically? ; 3) why certain pains are unpredictable (presence of more ion channels in the wall of the nerves because hypersensitive, these ion channels respond to various mechanical, thermal or chemical stimuli, therefore the pain can be caused by stress, cold or immune changes); 4) other (disability, pain not equal to injury) 3) why some pain is diffuse (explanation of central sensitization and immune changes); Section 5 explains: 1) what are the treatment options? 2) How does the treatment work? 3) How to apply the treatment? Treatment Options: i) Understanding Pain, ii) Problem Solving, iii) Pain Coping, iv) Specific Medications, v) Relaxation Techniques, vi) Gradual Exposure, vii) Aerobic Physical Activity, viii) Goal Setting , ix) drink water, x) pacing, xi) sleep hygiene, xii) lifestyle: limit sedentary lifestyle, weight loss, smoking cessation..
Lehman [66]	Why are you telling me all this? 1) Makes it possible to change the way of approaching the problem; 2) establish its own rehabilitation program; 3) better manage pain and 4) adopt the right behaviors. Chapter I: explanation of the mechanisms of pain (importance of understanding pain, what pain is, nociception, ascending nociceptive pathways, role of the spinal cord and brain, role of pain, pain memory, sensitization, desensitization , cortical reorganization) to better understand key messages, contributing factors and treatment; Chapter 2: the key messages make it possible to reconceptualize pain, to change beliefs and to adopt the right behaviors vis-à-vis pain (pain is an alarm that protects, pain weakly correlated with lesions, pain equals sensitivity rather than lesion, factors may influence sensitivity, protection may be over-amplified and persist after tissue has healed, pain may be bizarre, we are strong and adaptable, we respond positively to physical stress, dysfunction not equal to pain, no need to be put back in place, no movement is prohibited forever); Chapter 3: helps to understand that pain is not just a reflection of the state of the tissues, and how it can be influenced by a multitude of anatomical factors (osteoarthritis), physical (physical constraint, strength and flexibility, asymmetry) , emotional (catastrophism, kinesiophobia), behavioral (avoidance, persistence) or related to lifestyle (stress, sleep), social and comorbidities + demystification of the importance of certain factors (physical constraint, osteoarthritis, strength and flexibility, physical asymmetry). Understand that we don't need to be put in place by someone: concepts of self-efficacy, adapted behaviors and our body's ability to adapt; Chapter 4: 1) identify relevant factors; 2) appropriate recovery program in place. Treatment options: i) sports and physical activity, ii) resuming hobbies and activities that matter; iii) stress management; iv) sleep hygiene; v) gradual exposure; vi) diet, vii) doing things that make us happy, viii) focusing on successes. And a reminder: a) adaptability; b) effect of treatment on adaptability; c) how to achieve the gradual exposure; d) cognitive principles, and so on.
Butler and Moseley (2013) [8]	Section 1: evokes general concepts with anecdotes, scientific studies, metaphors and analogies: 1) pain is normal; 2) nociception is neither necessary nor sufficient to produce pain; 3) pain is produced by the brain based on the perceived threat to the body; 4) pain depends on the context; 5) the amount of pain does not reflect the amount of degeneration or injury. Section 2 describes the neurophysiology of nociceptive pathways (nociceptors, ion channels, neurons, action potential, nociception, synapses, inhibitory and facilitative chemicals, spinal cord, descending pro and anti-nociceptive pathways), pain (neuromatrix, role of the brain) and other protective systems (sympathetic, endocrine, immune and motor), with simplified literal explanations, diagrams, graphs, metaphors and analogies to reinforce the general concepts mentioned above. Section 3: discusses the physiology and particularities (solidity, healing, inflammation, acid release) of different body tissues (skin, muscle, disc, bone, joint, dorsal root ganglion, nerves) with a focus on neuropathic pain. Section 4: describes the alteration of the central nervous system at the level of the spinal cord and the brain (sensitization of the pain neuromatrix) and of the other homeostatic systems (sympathetic, endocrine, immune and motor) inducing an over activity of the protective systems bodily + how thoughts and beliefs can help maintain this state. Section 5: discusses modern models of pain management (neuromatrix model, onion model, fear-based models, evolutionary model, clinical decision-based model), the need for the patient to be an actor of its management, and the exploration of cognitive-behavioral concepts (fears, coping, behavior) related to pain. Section 6: discusses care based on neuroscience, namely: 1) understanding your pain; 2) gradual exposure and pacing; 3) accessing the virtual body to desensitize the neuromatrix and protective systems.
Moseley and Butler (2015) [9]	Part 1: Reminder of concepts covered in Explain Pain: 1) pain is not a good indicator of tissue condition; 2) imaging is not a good indicator of pain; 3) pain is produced by the brain 100% of the time; 4) pain depends on context, all with literal explanations, anecdotes, reflective questions, scientific studies…to reinforce these concepts. Part 2: presentation of the theory that pain occurs when the brain concludes that there is more evidence of harm than evidence of safety for body tissues. 1) SIMs/DIMs are neuro-immune circuits; 2) SIMs represent all situations (thoughts, behavior, words, context) that make a person feel safer; 3) DIMs represent all situations that make a person feel in danger; 4) explanation of the protectometer tool and the biological influence of DIMs/SIMs on it; 5) Protectometer user manual; 6) other concepts: i) other protection systems (sympathetic, endocrine, immune) can load the protectometer; ii) protection systems can become overactive when danger signals persist; iii) harmless events can now cause the pain, without really being the problem (with literal explanations & metaphors). Part 3: preparation: 1) check for red flags; 2) negative & positive bioplasticity; 3) how to promote positive bioplasticity (remove DIMs, add SIMs). Part 4: Focused on management based on the concepts covered: 1) planning for recovery; 2) promote active coping strategies; 3) limit maladaptive behaviors

	and promote gradual exposure and pacing with reasoning based on the biology of pain (tissues, pain, avoid flare-ups); 4) understand that knowledge is analgesic because it is the brain that produces pain; 5) favoring a SIM rather than DIM language; 6) understand that the protector is the key (with drawings, literal explanations, metaphors, graphics).
Louw and al (2013) [64]	This book uses texts, diagrams, metaphors, anecdotes, graphics, analogies, scientific studies, simplified biological explanations, and general concepts to facilitate the transmission of biological concepts. Section 1: discusses tissue injury, inflammation, neuroimmune sensitization, tissue scarring, desensitization + contrast with people whose pain threshold does not return to baseline despite tissue scarring. Link between nerve sensitization and decreased function. Proposal of psychosocial factors that may explain the maintenance of awareness. Explanation of ion channels to give meaning to unpredictable pain (stress, illness, cold, atmospheric pressure); Section 2: explanation of secondary hyperalgesia via the immune system (history of noisy neighbors); Section 3: explanation of secondary hyperalgesia via hypervigilance and pronociceptive facilitation (history of the PDG of the body); Section 4: explanation of the pain neuromatrix + Hebb's law (ex: board of directors, aerial maps); Section 5: pain is produced by the brain according to the perceived threat to protection (metaphor of the sprain and the bus); Section 6: physiological explanation of stress and long-term impact on protection systems + proposal of possible stressors (lion metaphor); Section 7: proposed treatment to desensitize the nervous system: 1) knowledge; 2) progressive aerobic exercise; 3) specific medication (antidepressant type) to target descending inhibition; 4) sleep hygiene; 5) pacing and goal setting.
Moseley (2007) [68]	This book mainly uses anecdotes and metaphors to facilitate the transmission of biological concepts. Chapter 1: pain is an essential protection system for survival; Chapter 2: pain is a protector; Chapter 3: pain does not measure the condition of tissues; Chapter 4: pain is a complex conscious experience based on the interaction of many signals; Chapter 5: pain is the conscious reflection of the perceived threat to our tissues; Chapter 6: the virtual body; Chapter 7: Pain depends on the answer to the question “how dangerous is it”? ; Chapter 8: Nociception is not sufficient to produce pain; Chapter 9: Nociception is not sufficient NOR necessary to produce pain; Chapter 10: the brain analyzes information based on perceived vulnerability and threat; Chapter 11: Neural networks that produce pain become more sensitive when pain persists.

Supplementary Table 2: General data of included studies

Protocol study (10)

Author, year of publication, title and country of the study	Intervention and comparator	Study population	Objective(s)	Design	Outcome measure(s)	Important result(s)
Adenis et al (2020), Evaluation of the effectiveness of pain neurophysiology education compared to a conventional education combined with multidisciplinary rehabilitation, in chronic low back pain patients: a protocol for a randomized controlled trial, France [17]	PNE + multidisciplinary management *versus* Conventional Education + multidisciplinary management	Chronic low back pain	Evaluation of efficacy of PNE compared with conventional education in a multidisciplinary program on function at D90.	Protocol study of a Randomized Control Trial	Roland Morris Disability Questionnaire (primary outcome)	N / A
Dolphens et al (2014), Efficacy of a modern neuroscience approach versus usual care evidence-based physiotherapy on pain, disability and brain characteristics in chronic spinal pain patients: protocol of a randomized clinical trial, Belgium [62]	PNE + cognition-targeted motor control training *versus* usual care physiotherapy	Chronic spinal pain	To assess the effectiveness of a modern neuroscience approach, compared to usual care evidence-based physiotherapy, for reducing pain and improving functioning in patients with CSP	Multi-center, triple-blind, two-arm (1:1) randomized clinical trial with 1-year follow-up.	The main outcome measures are pain (including symptoms and indices of central sensitization) and self-reported disability.	N / A
Lane et al (2018), The effectiveness of training physical therapists in pain neuroscience education on patient reported outcomes for patients with chronic spinal pain: a study protocol for a cluster randomized controlled trial, USA [19]	PNE training *versus* continue with usual care	Chronic neck or back pain	To determine the effectiveness of providing physical therapists with PNE training on patient-centered outcomes for patients with chronic neck or back pain undergoing care by a physical therapist	Cluster randomized trial	The primary outcome will be the Patient Reported Outcomes Measurement Information System (PROMIS) Physical Function computer-adapted test (PF-CAT)	N / A
Malfliet et al (2017), Applying contemporary neuroscience in exercise interventions for chronic spinal pain: treatment protocol, Belgium [20]	PNE + cognition-targeted motor control training *versus* usual care physiotherapy	Nonspecific chronic spinal pain	To provides the treatment protocol used in a large randomized controlled trial that aimed to assess the effectiveness of a modern neuroscience approach compared to usual care evidence-based physiotherapy	Protocol of a randomized controlled clinical trial	N / A	N / A
Malfliet et al (2019), The added value of cognitive	CBT-I combined with the modern neuroscience	Chronic spinal pain	To examine whether CBT-I combined with the modern	Protocol of a randomized controlled clinical trial	Primary outcome measure: self-reported pain severity	N / A

behavioral therapy for insomnia to current best evidence physical therapy for chronic spinal pain: protocol of a randomized controlled clinical trial, Belgium [21]	approach (PNE + cognition-targeted motor control) *versus* modern neuroscience approach alone.		neuroscience approach (i.e. pain neuroscience education plus cognition-targeted exercise therapy is superior to the modern neuroscience approach alone to reduce pain (primary outcome measure).		(Brief Pain Inventory)	
O'Keeffe et al (2015), Individualised cognitive functional therapy compared with a combined exercise and pain education class for patients with non-specific chronic low back pain: study protocol for a multicentre randomised controlled trial, Ireland [69}	Individualiz5.ed cognitive functional therapy (CFT) *versus* combined exercise and pain education class	Nonspecific chronic low back pain	To examine the clinical effectiveness of CFT, based on whether participants in the CFT arm report significant improvements in the short, medium and long term on measures of functional disability and pain intensity, relative to those allocated to combined exercise and pain education classes.	Protocol of a randomized controlled clinical trial	The two primary outcomes of interest will be functional disability (ODI) and pain intensity (NRS)	N / A
Vier et al (2018), Effects of spinal manipulation and pain education on pain in patients with chronic low back pain: a protocol of randomized sham-controlled trial, Brazil [70]	Spinal manipulation + PNE *versus* sham treatment + PNE	Chronic nonspecific low back pain	To verify the pain control, functional and neurophysiological effects of spinal manipulation, and pain education in individuals with chronic nonspecific LBP	Protocol of an assessor and subject blinded, 2-arm, randomized sham-controlled trial	The measures will be applied at baseline, six weeks, and three months after randomization. The primary outcome will be a pain intensity at six weeks postrandomization	N / A
Werner et al (2010). The COPE LBP trial: Cognitive Patient Education for Low Back Pain - a cluster randomized controlled trial in primary care, Norway [57]	PNE *versus* normal treatment	Nonspecific sub-acute/chronic low back pain of more than four weeks but less than 1 year's duration	To evaluate whether a specific cognitive based education program for patients with LBP in primary care is more effective than normal care in terms of increased function	Protocol of a cluster randomized controlled trial	The primary outcome is function (disability) assessed by the Roland Morris Disability Questionnaire (RMQ)	N / A
Ibrahim et al (2019), Effects of motor control exercise and patient education program in the management of chronic low back pain among community-dwelling adults in rural Nigeria: a study protocol for a randomized clinical trial, Nigeria [61]	motor control exercise + PNE *versus* motor control exercise *versus* PNE	Chronic low back pain	To investigate the effects of motor control exercise (MCE) and patient education (PE) for the management of CLBP among community-dwelling adults in rural Nigeria	Protocol of an assessor-blind, 3-arm parallel randomized clinical trial	Participants will be assessed pre-intervention, immediately post-intervention and at 3-month post-intervention. Primary outcomes will be pain intensity and functional disability	N / A
Galan-Martin et al (2019). Pain neuroscience education and physical exercise for patients with chronic spinal pain in primary healthcare: a	PNE + therapeutic exercise *versus* usual physiotherapy	Chronic spinal pain	To compare the effectiveness of a PNE and PE combination therapy program versus usual physiotherapeutic treatment used in PC physiotherapy units for CSP.	Randomized multicentre clinical trial protocol	Outcomes : quality of life. The outcome variables will be measured at the beginning of the intervention, after the intervention (week 11), at six months, and a year.	N / A

randomised trial protocol, Spain [18]

Randomized Control Trial (14)

Author, year of publication, title and country of the study	Intervention and comparator	Study population	Objective(s)	Design	Outcome measure(s)	Important result(s)
Bodes Pardo et al (2018), Pain Neurophysiology Education and Therapeutic Exercise for Patients With Chronic Low Back Pain: A Single-Blind Randomized Controlled Trial, Spain [54]	Group of therapeutic exercise + PNE *versus* therapeutic exercise	Chronic low back pain > 6 months	To assess the effect of a pain neurophysiology education (PNE) program plus therapeutic exercise (TE) for patients with chronic low back pain (CLBP)	Single-blind randomized controlled trial	The primary outcome was pain intensity rated on the numerical pain rating scale which was completed immediately after treatment and at 1- and 3-month follow-up	At 3-month follow-up, a large change in pain intensity (numerical pain rating scale: 2.2; 2.93 to 1.28; P<0,001; dZ1.37) was observed for the PNE plus TE group, and a moderate effect size was observed for the secondary outcome measures
Galan-Martin et al (2020), Pain Neuroscience Education and Physical Therapeutic Exercise for Patients with Chronic Spinal Pain in Spanish Physiotherapy Primary Care: A Pragmatic Randomized Controlled Trial, Spain [25]	PNE + therapeutic exercise *versus* usual physiotherapy	Chronic spinal pain	To compare the effectiveness of a PNE and PE combination therapy program versus usual physiotherapeutic treatment used in PC physiotherapy units for CSP.	Randomized multicentre clinical trial	The main measure of outcome was the difference between groups in the change in health-related quality of life (HRQL) at different times (initial assessment, post-intervention, and 6 months). The Spanish version of the SF-36 v2 health survey was used	The experimental treatment improved quality of life (d = 1.8 in physical component summary), catastrophism (d = 1.7), kinesiophobia (d = 1.8), central sensitization (d = 1.4), disability (d = 1.4), pain intensity (d = 3.3), and pressure pain thresholds (d = 2). Differences between the groups ($p < 0.001$) were clinically relevant in favour of the EG. Improvements post-intervention (week 11) were maintained at six months
Moseley et al (2004), A randomized controlled trial of intensive neurophysiology education in chronic low back pain, Australia [47]	individual PNE *versus* back anatomy education	Chronic low back pain patients	To evaluate the effect of a formal intensive neurophysiology education program in chronic LBP patients	Blinded randomized controlled trial	Cognitions were evaluated using the Survey of Pain Attitudes (revised) (SOPA(R)), ; Pain Catastrophizing Scale (PCS) ; Behavioral measures included the Roland Morris Disability Questionnaire (RMDQ), and 3 physical performance tasks; (1) straight leg raise (SLR), (2) forward bending range, and (3) an abdominal “drawing-in” task, which provides a measure of voluntary activation of the deep	There was a significant treatment effect on the SOPA(R), PCS, SLR, and forward bending. There was a statistically significant effect on RMDQ; however, the size of this effect was small and probably not clinically meaningful

					abdominal muscles	
Moseley (2003), Joining Forces – Combining Cognition-Targeted Motor Control Training with Group or Individual Pain Physiology Education: A Successful Treatment For Chronic Low Back Pain, Australia [45]	Individualize8d PNE *versus* group PNE	Chronic unremittent low back pain	To answer the two questions posed above with the hypotheses: (i) intervention based on a cognition-specific motor control training approach combined with pain physiology education is effective in reducing pain and disability associated with chronic LBP, and (ii) group physiology education is cheaper than, and equally as effective as individualized physiology education	Randomized comparative trial	8-item Roland Morris Disability Questionnaire (RMDQ) 14 and (0-10) Numerical Rating Scale (NRS) for pain. The first assessment, second assessment (36 ± 4 days later), and third assessment (25 ± 2 days later) were performed. A follow-88up telephone assessment was conducted 348 ± 13 days after the third assessment.	Both groups reduced pain (numerical rating scale) and disability (Roland Morris Disability Questionnaire). IE showed bigger decreases, which were maintained at 12 months (P<0.05 for all). The combined motor control and education approach is effective. Although group education imparts a lesser effect, it may be more cost-efficient
Orhan et al (2019), Culture-sensitive and standard pain neuroscience education improves pain, disability, and pain cognitions in first-generation Turkish migrants with chronic low back pain: a pilot randomized controlled trial, Belgium [28]	culture-sensitive PNE *versus* standard PNE	First generation Turkish migrants with chronic low back pain	To compare the effectiveness of culture-sensitive and standard pain neuroscience education (PNE) on pain knowledge, pain intensity, disability, and pain cognitions in first-generation Turkish migrants with chronic low back pain (CLBP)	Pilot randomized controlled trial	Primary (pain knowledge, pain intensity, and disability) and secondary outcomes (pain beliefs, catastrophization, and fear of movement) were evaluated at baseline, immediately after the second session of PNE (week 1), and after 4 weeks	There was a significant main effect of time in pain knowledge ($p < .001$), pain intensity ($p = .03$), disability ($p = .002$), organic and psychological pain beliefs ($p = .002$, $p = .01$), catastrophization ($p = .002$), and fear of movement ($p = .02$). However, no significant difference was found between groups in terms of all outcome measures ($p > .05$)
Pires et al (2014), Aquatic exercise and pain neurophysiology education versus aquatic exercise alone for patients with chronic low back pain: a randomized controlled trial, Portugal [53]	aquatic exercise and PNE *versus* aquatic exercise alone	Chronic low back pain	To compare the effectiveness of a combination of aquatic exercise and pain neurophysiology education with aquatic exercise alone in chronic low back pain patients	Single-blind randomized controlled trial	The primary outcomes were pain intensity (Visual Analogue Scale) and functional disability (Quebec Back Pain Disability Scale) at the baseline, 6 weeks after the beginning of the aquatic exercise program and at the 3 months follow-up	Fifty-five participants completed the study. Analysis using mixed-model ANOVA revealed a significant treatment condition interaction on pain intensity at the 3 months follow-up, favoring the education group (mean SD change: –25.4± 26.7 vs –6.6 ± 30.7, $P < 0.005$)
Saracoglu et al (2020), The effectiveness& of pain neuroscience education combined with manual therapy and home exercise for chronic low back pain : a single-blind randomized controlled trial, Turkey [32]	PNE + manual therapy + home exercise *versus* manual therapy + home exercise	Chronic low back pain	To investigate the short- and mid-term effects of pain neuroscience education (PNE) combined with manual therapy (MT) and a home exercise program (HEP) on pain intensity, back performance, disability, and kinesiophobia	Prospective, randomized, controlled, single-blind study	The participants' pain intensity, disability, low back performance, and kinesiophobia were assessed. All assessments were executed before intervention, at 4 weeks, and at 12 weeks post-intervention by the same	Analysis of pain level ($p < .05$), back performance ($p < .05$), disability ($p < .05$) and kinesiophobia ($p < .05$) revealed significant time, group, and time-by-group interaction effects. The participants in Group 1

			in patients with chronic low back pain (CLBP)		blinded physiotherapist	exhibited greater improvement in terms of pain intensity and kinesiophobia compared to the participants in Group 2 and the control group. Level of disability was significantly decreased in both Group 1 and Group 2 compared to the control group
Saracoglu et al (2020). The short-term effects of neuroscience pain education on quality of life in patients with chronic low back pain: A single-blinded randomized controlled trial, Turkey [33]	PNE + manual therapy *versus* traditional patient education + manual therapy	Chronic low back pain	To investigate the short-term effects of PNE in patients with CLBP treated with manual therapy	Randomized controlled study	Outcome measures were the Short Form-36 (SF-36) quality of life (QoL) questionnaire and the Numeric Pain Rating Scale for low back pain measured before and after treatment	Both intervention and control group had significant effects on pain and quality of life. Between-group comparisons revealed a significant difference in pain severity ($p = 0.01$) and SF-36 physical function subscale ($p = 0.04$) in favor of the NPE group
Téllez-Garcia et al (2015), Neuroscience education in addition to trigger point dry needling for the management of patients with mechanical chronic low back pain: A preliminary clinical trial, Spain [49]	PNE + trigger point dry needling *versus* trigger point dry needling alone	Chronic non specific low back pain	To determine the short-term effects of trigger point dry needling (TrP-DN) alone or combined with neuroscience education on pain, disability, kinesiophobia and widespread pressure sensitivity in patients with mechanical low back pain (LBP)	Preliminary clinical trial	Pain intensity (Numerical Pain Rating Scale, 0-10), disability (Roland-Morris Disability Questionnaire-RMQ-, Oswestry Low Back Pain Disability Index-ODI), kinesiophobia (Tampa Scale of Kinesiophobia-TSK), and pressure pain thresholds (PPT) over the C5-C6 zygapophyseal joint, transverse process of L3 vertebra, second metacarpal, and tibialis anterior muscle were collected at baseline and 1-week after the intervention	Patients treated with TrP-DN + EDU experienced a significantly greater reduction of kinesiophobia ($P = 0.008$) and greater increases in PPT over the transverse process of L3 ($P = 0.049$) than those patients treated only with TrP-DN. Both groups experienced similar decreases in pain, ODI and RMQ, and similar increases in PPT over the C5/C6 joint, second metacarpal, and tibialis anterior after the intervention (all, $P > 0.05$)
Unal et al (2020), Investigating the effects of myofascial induction therapy techniques on pain, function and quality of life in patients with chronic low back pain, Turkey [35]	Myofacial induction therapy *versus* PNE	Chronic low back pain	to comparatively investigate the effects of myofascial induction therapy (MIT) against pain neuroscience education (PNE) on pain and function in patients with chronic low back pain (CLBP)	Prospective, randomized-controlled and single-blind study	Primary outcome measure : Roland Morris disability questionnaire, McGill pain questionnaire	Within both groups, all outcome scores showed a significant improvement ($p < 0.05$). After 8-week, SF-36 physical function, physical role and mental health scores significantly improved in MIT group compared with PNE group, finger floor test score significantly decreased in MIT group compared with PNE group, and FABQ score significantly decreased in PNE

						group compared with MIT group ($p < 0.05$)
Wälti et al (2015), Short-term effect on pain and function of neurophysiological education and sensorimotor retraining compared to usual physiotherapy in patients with chronic or recurrent non-specific low back pain, a pilot randomized controlled trial, Switherland [71]	Multimodal treatment (PNE + sensory training + motor control training) *versus* usual physiotherapy treatment	Patients with nonspecific chronic low back pain, considerable disability (five or more points on the Roland and Morris Disability Questionnaire (RMDQ) and medium or high risk of poor outcome on the Keele Start Back Tool (KSBT)	To investigate the feasibility of MMT, prior to a larger RCT, with focus on patients' adherence and the evaluation of short-term effects on pain and disability of MMT when compared to usual physiotherapy	Randomized controlled trial (RCT)	The primary outcome was pain (NRS 0-10) and the secondary outcome was disability (RMDQ	Pain reduction (NRS; [95% CI]) was 2.14 [1.0 to 3.5] in the MMT and 0.69 [-2.0 to 2.5.] in the UPT. The between-group difference was 1.45 [0.0 to 4.0] ($p = 0.03$), representing a moderate effect size of 0.66 [-0.1 to 1.5]. Reduction in disability on the RMDQ was 6.71 [4.2 to 9.3] in MMT and 4.69 [1.9 to 7.4] in UPT, with a non-significant between-group difference of 2.02 [-1.5 to 5.6] ($p = 0.25$)
Moseley (2002), Combined physiotherapy and education is efficacious for chronic low back pain, Australia [41]	PNE + manual therapy + exercise *versus* management as directed by their general practitioners	Chronic low back pain	To determine the efficacy of a combined physiotherapy treatment that comprised all of these strategies	Randomized controlled trial	The following items were used as outcome measures: the 18-item Roland Morris Disability Questionnaire (RMDQ; Roland and Morris 1983) and the 0-10 Numerical Rating Scale (NRS) for pain	Outcome data from 49 subjects (86%) showed a significant treatment effect. The physiotherapy program reduced pain and disability by a mean of 1.5/10 points on a numerical rating scale (95% CI 0.7 to 2.3) and 3.9 points on the 18-point Roland Morris Disability Questionnaire (95% CI 2 to 5.8) , respectively. The number needed to treat in order to gain a clinically meaningful change was 3 (95% CI 3 to 8) for pain, and 2 (95% CI 2 to 5) for disability. A treatment effect was maintained at one-year follow-up
Louw et al (2016), The effect of manual therapy and neuroplasticity education on chronic low back pain: a randomized clinical trial, USA [51]	Neuroplasticity explanation (part of PNE) + manual therapy technique *versus* mechanical explanation + manual therapy technique	Chronic low back pain	To determine if a neuroplasticity educational explanation for a manual therapy technique will produce a different outcome compared to a traditional mechanical explanation	Randomized clinical trial	Following consent, demographic data were obtained as well as pain ratings for low back pain (LBP) and leg pain (Numeric Pain Rating Scale), disability (Oswestry Disability Index), fear-avoidance (Fear-Avoidance-Beliefs Questionnaire), forward flexion (fingertips-to-floor), and straight leg raise (SLR) (inclinometer)	There were no statistically significant interactions for LBP ($p = .325$), leg pain ($p = .172$), and trunk flexion ($p = .818$) between the groups, but SLR showed a significant difference in favor of the neuroplasticity explanation ($p = .041$). Additionally, the neuroplasticity group were 7.2 times (95% confidence interval = 1.8-28.6) more likely to improve beyond the MDC on

						the SLR than participants in the mechanical group
Ibrahim et al (2018), Motor control exercise and patient education program for low resource rural community dwelling adults with chronic low back pain: a pilot randomized clinical trial, Nigeria [56]	Patient education + Motor control exercise *versus* patient education *versus* motor control exercise	Chronic low back pain	To assess the feasibility of implementing MCE and PE program in the management CLBP in a low resource rural Nigerian community	Pilot randomized clinical trial	Feasibility was assessed through recruitment rate, treatment compliance, retention/dropout rate, report of adverse events, perceived helpfulness, overall satisfaction, and clinical outcome of pain (numeric pain rating scale) and functional disability (Oswestry Disability Index)	Many patients were willing to participate in the study and the recruitment rate was 77%. Treatment compliance in all the three groups were > 65% for supervised treatment sessions and < 50% for prescribed home program. Retention rate was high and greater overall satisfaction with the interventions was reported. Compared with the baseline, all the three groups improved

Other clinical trial (4)

Author, year of publication, title and country of the study	**Intervention and comparator**	**Study population**	**Objective(s)**	**Design**	**Outcome measure(s)**	**Important result(s)**
Mansouri et Kostur (2018), Preliminary descriptive study on pain neurophysiology education for patients with chronic low back pain: Use of an illustrative brochure, France [73]	PNE booklet + multidisciplinary program *versus* multidisciplinary program alone	Chronic low back pain	To assess the relevance of PNE education in the physiotherapy management of chronic low back pain patients and to assess whether its illustration by a brochure is an appropriate tool for the transmission of knowledge to this patient.	Non randomized controlled trial	Each patient, on inclusion in the study (D0), performed two assessments. The first assesses the intensity of his lumbar pain using the simple verbal scale (EVS): at the present moment (EVS 1), usually for the last eight days (EVS 2) and the most intense for the eight last days (EVS 3). The second evaluates the functional impact of lumbar pain in activities of daily living (ADL) through the Dallas questionnaire which goes beyond the limitations of the patient's physical abilities by exploring daily activities (Dallas 1), occupations and hobbies (Dallas 2), anxiety and depression (Dallas 3) and sociability (Dallas 4).	Concerning the simple verbal scale, a better score is observed for the experimental group on the intensity of the pain and its functional repercussions in the chronic low back pain patient who received a brochure compared to those who did not receive one, in the short and long terms. Discussion. – The small population sample included does not allow conclusions to be drawn on the effects of the illustration by a brochure on NPD for the population with chronic low back pain compared to those not receiving the brochure during their rehabilitation, on the intensity of the pain and its functional repercussions in the activities of daily living, in the short, medium and long term.
Moseley (2004), Evidence for a direct relationship between cognitive and physical change	individual PNE *or* individual spine physiology	Moderately disabled chronic low back pain	To determine if a relationship exists between change in pain cognitions and change in	Quasi experimental study	Multiple regression analysis evaluated the relationship between change in pain	There was a strong relationship between cognitive change and change in straight leg raise

during an education intervention in people with chronic low back pain, Australia [46]			physical performance when chronic LBP patients participate in a single one-to-one education intervention during which they have no opportunity to be active		cognitions measured by the survey of pain attitudes (SOPA) and the pain catastrophizing scale (PCS) and change in physical performance, measured by the straight leg raise (SLR) and standing forward bending range	(SLR) and forward bending (r=0:88 and 0.79, respectively, P < 0:01), mostly explained by change in the conviction that pain means tissue damage and catastrophizing
Rufa et al (2018), The use of pain neuroscience education in older adults with chronic back and/or lower extremity pain, USA [31]	PNE	A 3 month or greater history of lower back (> 50%) and/or lower extremity pain	The primary purpose of this quasi experimental feasibility study was to determine whether adults over the age of 65 with chronic pain find PNE to be understandable, relevant and helpful	Quasi-experimental feasibility study	Subjects' perception of PNE was measured after the second session and gait speed, pain disability, and fear of movement were measured pre- and post-PNE	Subjects consistently reported a positive experience with PNE. There were statically significant positive improvements in gait speed, pain disability, and fear of movement after the intervention
Louw et al (2017), De-educate to re-educate: Aging and low back pain, USA [37]	de-education session regarding aging and low back pain (LBP) (part of PNE)	Chronic low back pain	To determine if a brief de-education session regarding aging and low back pain (LBP) can shift pain ratings, fear-avoidance beliefs, beliefs regarding aging and LBP, and limited active trunk flexion	Case serie	Prior to and immediately after the education pain ratings for LBP and leg pain (numeric pain rating scale-NPRS), fear-avoidance (fear avoidance belief questionnaire - FABQ), beliefs regarding aging and LBP (Likert scale) and active trunk flexion were measured	Significant changes were found in positive shifts with LBP ($p = 0.002$), leg pain ($p = 0.042$), FABQ-physical activity subscale ($p = 0.004$) and active trunk forward flexion ($p < 0.001$)

Systematic review (4)

Author, year of publication, title and country of the study	**Intervention and comparator**	**Study population**	**Objective(s)**	**Design**	**Outcome measure(s)**	**Important result(s)**
Clarke et al (2011), Pain neurophysiology education for the management of individuals with chronic low back pain: systematic review and meta-analysis. United Kingdom [5]	PNE	Chronic low back pain	To investigate the evidence for PNE in the management of patients with CLBP	Systematic review with meta-analysis	The main outcome measures were pain, physical-function, psychological-function, and social-function	Two moderate quality RCTs (n=122) were included in the final review. According to the CBRG criteria there was very low quality evidence that PNE is beneficial for pain, physical-function, psychological-function, and social-function. Meta-analysis found PNE produced statistically significant but clinically small improvements in short-term pain of 5 mm (0, 10.0 mm) [mean difference (95%CI)] on the 100 mm VAS

Tegner et al (2018). Neurophysiological Pain Education for Patients With Chronic Low Back Pain: A Systematic Review and Meta-Analysis. Danemark.[6]	PNE *versus* no intervention OR usual care	At least 50 % of patients with CLBP	To evaluate the effect of neurophysiological pain education (NPE) for patients with chronic low back pain (CLBP)	Systematic Review and meta-analysis	The effect of NPE was summarized in a random effect meta-analysis for pain, disability, and behavioral attitudes	Seven randomized-controlled trial studies (6 low and 1 high quality) were included. Statistically significant differences in pain, in favor of NPE, were found after treatment, WMD=-1.03 (95% confidence interval [CI], -0.55 to -1.52), and after 3 months, WMD=-1.09 (95% CI, -2.17 to 0.00). Furthermore statistically significant lower disability was found in the NPE group after treatment, SMD=-0.47 (95% CI, -0.80 to -0.13) and after 3 months SMD=-0.38 (95% CI, -0.74 to -0.02). The difference in favor of NPE in reduction in Tampa Scale of Kinesiophobia was not statistically significant, WMD=-5.73 (95% CI, -13.60 to 2.14) and after 3 months WMD=-0.94 (95% CI, -6.28 to 4.40)
Wood et al (2019). A systematic review and meta-analysis of pain neuroscience education for chronic low back pain: Short-and long-term outcomes of pain and disability, United Kingdom.[7]	PNE could be delivered in isolation or in combination with other forms of physiotherapy treatment: *versus* waitlist controls, physiotherapy, other educational methods or no treatment	Chronic low back pain	To evaluate randomized controlled trials comparing the effectiveness of PNE on pain and disability in CLBP	Systematic review with meta-analysis	The outcome measures of pain and disability were included for this review. The principal summary method was mean difference between-groups assessed at short term (<12 weeks) and long (>1 year) term follow-up. Adverse events were also captured where mentioned	A total of 6,767 papers were found, eight were included (n = 615). Meta-analysis for short-term pain (n = 428) demonstrated a WMD of 0.73 (95%CI -0.14, 1.61) on a ten-point scale of PNE against no PNE (GRADE analysis low evidence). When PNE alongside physiotherapy interventions were grouped for pain (n = 212), a WMD of 1.32 was demonstrated (95% CI 1.08, 1.56, p < 0.00001; GRADE analysis moderate evidence). Short-term disability (RMDQ) meta-analysis demonstrated a WMD of 0.42 (95%CI 0.28, 0.56; p < 0.00001; n = 362; GRADE analysis moderate evidence); whereas the addition of PNE to physiotherapy interventions demonstrated a WMD of 3.94 (95% CI 3.37, 4.52; p <

						0.00001; GRADE analysis moderate evidence
Barbari et al (2020), Effectiveness of communicative and educative strategies in chronic low back pain patients : a systematic review, Italy [14]	communicative and educative strategies (including PNE) aimed at increasing compliance with exercise, modifying patient's maladaptive behavior or LB awareness/knowledge *versus* Waiting lists, usual care, placebo, no intervention, active or passive treatments, other educative interventions	Chronic low back pain	To investigate the effectiveness of communicative and educative strategies on 1) patient's low back pain awareness/knowledge, 2) maladaptive behavior modification and 3) compliance with exercise in patients with chronic low back pain	Systematic review	evaluate at least one of the three following outcomes: 1) maladaptive behavior modification, 2) compliance with exercise or 3) patient's LBP awareness/knowledge assessed with objective measures, patient-reported questionnaires or other modalities	24 randomized controlled trials which intervention included communicative and educative strategies were selected. Most of the studies were judged as low risk of bias and Cohen's Kappa was excellent (=0.822). Interventions addressed were cognitive behavioral therapy as unique treatment or combined with other treatments (multimodal interventions), coaching, mindfulness, pain science education, self-management, graded activity and graded exposure

Other literature review (1)

Author, year of publication, title and country of the study	**Intervention and comparator**	**Study population**	**Objective(s)**	**Design**	**Outcome measure(s)**	**Important result(s)**
Malfiet et al (2019), Best Evidence Rehabilitation for Chronic Pain Part 3: Low Back Pain, Belgium [22]	The best evidence non-invasive rehabilitation (including PNE)	Chronic low back pain	Therefore, this paper provides a state-of-the-art overview of the best evidence non-invasive rehabilitation for CLBP	Up-to-date evidence from systematic reviews, meta-analysis and available treatment guidelines (nonsystematic review)	pain and function as outcomes for chronic low back pain management	Most physically inactive therapies should not be considered for CLBP management, except for pain neuroscience education and spinal manipulative therapy if combined with exercise therapy, with or without psychological therapy. Regarding active therapy, back schools, sensory discrimination training, proprioceptive exercises, and sling exercises should not be considered due to low-quality and/or conflicting evidence

Qualitative study (1)

Author, year of publication, title and country of the study	Intervention and comparator	Study population	Objective(s)	Design	Outcome measure(s)	Important result(s)
King et al (2018), Pain Reconceptualisation after Pain Neurophysiology Education in Adults with Chronic Low Back Pain: A Qualitative Study, United Kingdom [48]	PNE	Chronic low back pain	To explore the extent, and nature, of patients' reconceptualization of their chronic low back pain (CLBP) following PNE	Qualitative study with thematic analysis (inductive & deductive)	semi-structured interview	We observed varying degrees of (1) degrees of reconceptualization, (2) personal relevance, (3) importance of prior beliefs, and (4) perceived benefit of PNE. We observed varying degrees of reconceptualization from zero to almost complete, with most participants showing partial reconceptualization. Personal relevance of the information to participants and their prior beliefs were associated with the degree of benefit they perceived from PNE. Where benefits were found, they manifested as improved understanding, coping, and function

Case studies / series (6)

Author, year of publication, title and country of the study	Intervention and comparator	Study population	Objective(s)	Design	Outcome measure(s)	Important result(s)
Agarwal et al (2020), Physician-Delivered Pain Neuroscience Education for Opioid Tapering: A Case Report, USA [23]	PNE in conjunction with monitored tapering of opioids and other medication.	75-year-old female with chronic low back pain	This case study demonstrates the delivery of PNE by an internal medicine physician to a patient with chronic pain and opioid use	Case sutdy	Pre-intervention and post-intervention Yellow Flags Questionnaire (YFQ) scores	The attending physician tapered opioids and other medicine associated with her CLBP, depending on her responses. Over the 12-week period (89 days since discharge from the hospital), the patient's CLBP decreased from 7/10 to 0/10 (Figure 1) and opioids and antidepressants were completely abolished (Figure 2). Both of these positive results were still intact at the final six-month follow-up
Anandkumar et al (2018), Effect of physical therapy	PNE (with individualized curriculum), mindfulness,	two patients, aged 35 and 45 years, respectively, who	This report is a potential first-time description of the	Case series	EA Inventory (EAI), Numeric Pain Rating Scale (NPRS);	At discharge, they were pain-free and fully functional,

management of nonspecific low back pain with exercise addiction behaviors: A case series, Canada [24]	breathing, quota-based reduction in exercises and modification of exercises into social participation, pleasure activities and hobbies	presented with chronic nonspecific low back pain having exercise addiction behaviors	successful physical therapy management of EA in chronic NSLBP using PNE (by adopting a pain curriculum), mindfulness, breathing, quota-based reduction in exercises and activity modification		Short Form 36 (SF-36) health survey and Global Rating of Change (GROC) scale were used as outcome measures. Both EAI and NPRS were measured at baseline and anticipated to be used at the beginning of each treatment session with the GROC measured after the first therapy session. SF-36 was measured at baseline and intended to be used after discharge from treatment	which was maintained at a six-month follow-up
Louw et al (2012), Use of an abbreviated neuroscience education approach in the treatment of chronic low back pain: a case report, USA [58]	Treatment consisted of an abbreviated PNE approach, exercises (range of motion, stretches, and cardiovascular), and aquatic therapy	A 64-year-old female with history of chronic low back pain	First, the report aims to show how a NE session can be applied in a time frame that is clinically reasonable (approximately 1 hour). Second, it aims to describe the clinical reasoning process used in determining that a NE session was needed for this patient. Third, the exact content of NE sessions are poorly described, and this case report aims to provide clinicians with a concise and effective way to deliver this intervention to a patient with central sensitization, using strategies, metaphors, and descriptions	Single case study	A physical examination, the Numeric Pain Rating Scale (NPRS), Oswestry Disability Index (ODI), Fear-Avoidance Beliefs Questionnaire (FABQ), and Zung Depression Scale were assessed during her initial physical therapy visit, immediately after her first physical therapy session, and at 7-month follow-up	She attended twice a week for 4 weeks, or 8 visits total. Pre-NE, the patient reported NPRS = 9/10; ODI = 54%; FABQ-W = 25/42,; FABQ-PA = 20/24, and Zung = 58. Immediately following the 75-minute evaluation and NE session, the patient reported improvement in all four outcome measures, most notably a reduction in the FABQ-W score to 2/42 and the FABQ-PA to 1/24. At a 7-month follow-up, all outcome measures continued to be improved.
Moseley (2005), Widespread brain activity during an abdominal task markedly reduced after pain physiology education: fMRI evaluation of a single patient with chronic low back pain, Australia [44]	PNE	A thirty-six year old female with a history of chronic disabling low back pain (~ 4.5 years since onset with a fall at work) and with no neural signs	Using a single case design, we were interested in whether pain physiology education had an effect on the pattern of brain activity during performance of this abdominal task. Changes in cortical activation should provide insight into the nature of the effect of pain physiology education on motor tasks	Case report	The abdominal drawing-in task, which involves a gentle drawing-in of the lower abdomen, was used for the study. Accurate performance can be verified by a trained physiotherapist and confirmed using real-time ultrasound. The following self-report measures were also used: McGill Pain Questionnaire, Roland Morris Disability Questionnaire , Fear Avoidance Beliefs Questionnaire, physical activity items, Pain Self-	Before education there was widespread brain activity during performance of the task, including activity in cortical regions known to be involved in pain, although the task was not painful. After education widespread activity was absent so that there was no brain activation outside of the primary somatosensory cortex

					Efficacy Questionnaire.	
Peterson et al (2019), Physical Therapy Management of Patients With Chronic Low Back Pain and Hip Abductor Weakness, USA [29]	Targeted exercise approach of hip abductor strengthening + additional treatments including heel lift and pain neuroscience education when indicated	Three non-consecutive patients with chronic low back pain: -a 77-year-old man, a 78-year-old woman, and an 85-year-old woman	To describe the physical therapy management and outcomes of 3 patients with CLBP matching a previously identified subgroup characterized by substantial hip abductor weakness	Case series	Outcome measures were administered at baseline, 4 weeks, discharge, and 3-month follow-up. Outcome measures were : NPRS, Global Rating of Change (GROC), Owestry Disability Index (ODI) and Fear Avoidance Beliefs Questionnaire (FABQ).	By discharge, all patients had made clinically important improvements in pain (3- to 7-point reduction on the Numeric Pain Rating Scale), function (10- to 16-point change on the Modifi ed Oswestry Disability Index), and perceived improvement (6-7 on Global Rating of Change Scale). Lumbar range of motion was painless, and hip abductor strength was improved from 2 +/5 to 3 +/5 in all 3 patients. These gains were maintained at 3-month follow-up
Toomey et al (2020), How manual therapy provided a gateway to a biopsychosocial management approach in an adult with chronic post-surgical low back pain: a case report, New Zealand [34]	12-week multimodal approach consisting of manual therapy, exercise rehabilitation, and PNE	A 44-year-old female presented to physiotherapy with a 13-year history of persistent pain, having had a spinal fusion 12 years prior, following a skiing accident	This case study will discuss the physiotherapy management of a 44-year-old woman with chronic postsurgical low back pain using manual therapy, pain neuroscience education and a progressive exercise program	Case report	Outcome measure Score Numerical Pain Rating Scale at rest 5/10 Oswestry Disability Index 42% Fear-Avoidance Beliefs Questionnaire 18/24	The patient had a significant reduction in the Numerical Pain Rating Scale (NPRS), the Oswestry Disability Index (ODI) and the Fear Avoidance Belief Questionnaire Physical Activity Subscale (FABQ-PA) scores following the intervention. She returned to running and cycling, reporting that pain was something she would 'work with instead of against'

Expert opinion (14)

Author, year of publication, title and country of the study	**Intervention and comparator**	**Study population**	**Objective(s)**	**Design**	**Outcome measure(s)**	**Important result(s)**
Nijs et al (2014), A modern neuroscience approach to chronic spinal pain: combining pain neuroscience education with cognition-targeted motor control training, Belgium [26]	Modern neuroscience approach (including PNE)	Chronic spinal pain	This perspective paper explains why and how such an approach to CSP can be applied in physical therapy practice	Perspective paper	N / A	N / A
Nijs et al (2011), How to explain central sensitization to	PNE	Unexplained chronic musculoskeletal pain	In what follows the reader is provided with a brief overview	Practice guideline	N / A	N / A

patients with 'unexplained' chronic musculoskeletal pain: practice guidelines, Belgium [31]			of the clinical evidence of pain physiology education in patients with chronic musculoskeletal pain. The largest part of the paper is dedicated to practice guidelines on how to apply pain physiology education in patients with chronic musculoskeletal pain			
Van Wilgen et Keizer (2012), The sensitization model to explain how chronic pain exists without tissue damage, The Netherlands [59]	the sensitization model	Chronic pain	To provide a clinical education model for nurses who work with patients with chronic pain	Review article	N / A	N / A
Moseley and Butler (2015), Fifteen years of explaining pain: the past, present, and future, Australia.[2]	PNE	People in pain	1) To describe the historical context and beginnings of EP, suggesting that it is a pragmatic application of the biopsychosocial model of pain, but differentiating it from cognitive behavioral therapy and educational components of early multidisciplinary pain management programs; 2) To address common misconceptions of EP that have emerged over the last 15 years, highlighting that EP is not behavioral or cognitive advice, nor does it deny the potential contribution of peripheral nociceptive signals to pain; 3) To explain that EP is grounded in strong theoretical frameworks, that its targeted effects are biologically plausible, and that available behavioral evidence is supportive; 4) To update available meta-analyses with results of a systematic review of recent contributions to the field and propose future directions by which we might enhance the effects of EP as part of multimodal pain rehabilitation	Critical review	N / A	N / A

Louw et al (2017), The clinical application of teaching people about pain, USA [36]	PNE	Chronic pain	The article systematically discusses key elements of PNE including examination, educational content, and delivery methods, merging of PNE with movement, goal setting, and progression	Perspective article	N / A	N / A
Moseley (2003), A pain neuromatrix approach to patients with chronic pain, Australia [42]	A pain neuromatrix approach (including PNE)	Chronic Pain	This paper presents an approach to rehabilitation of pain patients	Masterclass	N / A	N / A
Diener et al (2016) Listening is therapy : patient interviewing from a pain science perspective, USA [12]	The interview process focusing on a pain science perspective (before PNE)	Chronic musculoskeletal pain	This article highlights the interview process focusing on a pain science perspective as it relates to screening patients, establishing psychosocial barriers to improvement, and pain mechanism assessment	Perspective article	N / A	N / A
Wijma (2016). Clinical biopsychosocial physiotherapy assessment of patients with chronic pain: the first step in pain neuroscience education, Belgium [55].	clinical biopsychosocial assessment is recommended prior to PNE	Chronic pain	To describe the use of the Pain - Somatic factors - Cognitive factors - Emotional factors - Behavioral factors - Social factors - Motivation - model (PSCEBSM-model) during the intake, as well as a pain analysis sheet	Perspective article	N / A	N / A
Louw (2017) A Clinical Perspective on a Pain Neuroscience Education Approach to Manual Therapy, USA [60]	PNE and manual therapy	Chronic pain	To explore the notion of PNE and manual therapy co-existing	Perspective article	N / A	N / A
Lotze & Moseley (2015), Theoretical Considerations for Chronic Pain Rehabilitation, Germany [40]	Key aspects of modern pain rehabilitation (including PNE)	Chronic pain	A brief overview is provided of the key aspects of modern pain rehabilitation and the considerations that should lead our interaction with patients with chronic pain	Narrative review	N / A	N / A
Blieckenstaff & Pearson (2016), Reconciling movement and exercise with pain neuroscience education: A case for consistent education, Canada [38]	Conceptual framework of kinesthetic education that is consistent with and reinforces pain neuroscience education	Chronic pain	This article will introduce a conceptual framework of kinesthetic education that is consistent with and reinforces pain neuroscience education. This article will also provide some specific guidance for integrating pain neuroscience	Perspective article	N / A	N / A

			education with exercise and movement in a more congruent manner			
Nijs et al (2017), In the spine or in the brain? Recent advances in pain neuroscience applied in the intervention for low back pain, Belgium [27]	This approach includes cognitively preparing patients for exercise therapy using (therapeutic) pain neuroscience education, followed by cognition-targeted functional exercise therapy	Chronic low back pain	To show that CLBP is also characterized by differences in the morphology and functionality of the brain. Understanding these brain changes in CLBP improves our understanding not only of pain symptoms, but also of prevalent CLBP comorbidities like sleep disturbances and fear avoidance behaviour. The second part of the paper explains how clinicians can apply our current understanding of contemporary pain neuroscience to improve care for people with CLBP.	Narrative review and expert opinion	N / A	N / A
Puentedura et Flynn (2016), Combining manual therapy with pain neuroscience education in the treatment of chronic low back pain: A narrative review of the literature, USA [30]	PNE and manual therapy	Chronic low back pain	To review the literature supporting the inclusion of manual therapies in the therapeutic management of CLBP by re-thinking the value of "hands-on" interventions in combination with PNE and supervised exercise	Narrative review	N / A	N / A
Nijs et al (2015) Exercise therapy for chronic musculoskeletal pain: Innovation by altering pain memories. Belgium [39]	Integrating pain neuroscience education with exercise therapy	Chronic pain	Here the authors explain how musculoskeletal therapists can alter pain memories in patients with chronic musculoskeletal pain, by integrating pain neuroscience education with exercise interventions. The latter includes applying graded exposure in vivo principles during exercise therapy, for targeting the brain circuitries orchestrated by the amygdala (the memory of fear center in the brain)	Perspective article	N / A	N / A

Educational support (patient) (8)

Author, year of publication, title and country of the study	Intervention and comparator	Study population	Objective(s)	Design	Outcome measure(s)	Important result(s)
Pain In Motion, Pourquoi ma douleur persiste-t-elle ? Belgium [63]	PNE	Chronic pain	This brochure is intended to explain to you how the human body's pain processing system works. Let's start by describing the nervous system. The changes that occur when the pain becomes chronic and the phenomenon of increased sensitivity to pain will also be reprimanded. You will understand what can explain your pain by means of the most recent scientific discoveries. You will also find in this brochure advice that could be useful to you in your daily life.	Educational booklet for patient	N / A	N / A
Retrain Pain [65]	PNE	Chronic pain	This free online course teaches you an evidence-based approach to reducing your symptoms and getting back to the life you want.	Educational website for patient	N / A	N / A
Louw et al (2015) Everyone has back pain, USA [10]	PNE	Chronic low back pain	Our ultimate goal with this back book is to teach you how pain works and provide you with strategies for lessening the pain. In order to do this, we must address some of the misinformation and myths that exist about back pain.	Educational book for patient	N / A	N / A
Lehman (2017), Recovery Strategies, Canada [66]	PNE	Chronic pain	This booklet will give you some knowledge about pain, which, ideally, will allow you to manage it better.	Educational booklet for patient and practitioner	N / A	N / A
Butler et Mosley (2013), Explain Pain, Australia [8]	PNE	Chronic pain	1)To provide a conduit from the world of basic neuroscience to clinicians and to their patients; 2) To enable people in pain to understand more about their situation and to become less frightened of	Educational booklet for patient and practitioner	N / A	N / A

			their pain; 3) To assist people in pain, and those involved with them, to make the best choices about their management; 4) To outline modern models of management and provide the management essentials for overcoming pain and returning to normal life.			
Moseley et Butler (2015), The Explain Pain Handbook : Protectometer, Australia [9]	PNE	Chronic pain	Because understanding your pain is the single most important thing you can do to start on the road to recovery.	Educational book for patient	N / A	N / A
Louw et al (2013), Why Do I Hurt ? USA [64]	PNE	Chronic pain	It is important to know that persistent pain is more due to the nervous system sensory and how the brain processes information from the body and the environment. This book was written to teach you how the nervous system and the brain processes information and contributes to your painful experience. The latest research shows that the more you know about pain and its functioning, the better off you will be. This include moving and moving better, to feel less pain and to have a growing interest and ability to do more exercise and movement that can benefit your health. That knowledge is essential for your recovery.	Educational book for patient	N / A	N / A
Moseley (2007), Painful Yarns: Metaphors and Stories to Help Understand the Biology of Pain, Australia [68]	PNE	Chronic pain	First, I hope you find the stories as interesting and as fun as I do. Second, I hope the stories help you understand the biology of pain.	Educational storybook book for patient	N / A	N / A

Educational support for clinician

Author, year of publication, title and country of the study	Intervention and comparator	Study population	Objective(s)	Design	Outcome measure(s)	Important result(s)

Louw et al (2018), Pain Neuroscience Education, USA [13]	PNE	Chronic pain	Our original goal for writing this text was to create a single, user-friendly resource for clinicians and students learning to apply pain neuroscience education in the treatment of patients with chronic musculoskeletal pain complaints.	Educational support for practitioners	N / A	N / A
Moseley et Butler (2017), Explain Pain Supercharged, Australia [18]	PNE	Chronic pain	Explain Pain Supercharged is for all health professionals treating pain and indeed anyone teaching people about pain. In this brand new book, with entirely original content, Moseley and Butler apply their unique style to take the neuroimmune science of pain further and deeper, enriching your core knowledge while providing immediately applicable education strategies, conceptual change science, curriculum development and hundreds of ready to use clinical metaphors and therapeutic narratives.	Educational support for practitioners	N / A	N / A

N / A : Not applicable.