Special Sport for Special People

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SUPPORTING MANUAL

FOR THE KIT

BRAIN HEART & SPORT

INDEX

1. INTRODUCTION

Background

Regular participation in physical activity (PA) is imperative for good health. Active people benefit from higher levels of health-related fitness and are at lower risk of developing many different disabling medical conditions than inactive people. It is widely acknowledged that the health benefits of participation in PA are not limited to physical health but also incorporate mental components. Extensive research has resulted in clear recommendations of the level of PA required to produce health benefits. There are specific health-related recommendations for children and adolescents distinct from those for adults. For people aged 5–17 years it is recommended that they undertake moderate or vigorous activities for at least 60 minutes per day. Regular maintenance of this level of activity by children and adolescents can result in increased physical fitness, reduced body fat, favourable cardiovascular and metabolic disease risk profiles, enhanced bone health and reduced symptoms of depression and anxiety.

Whilst many different health benefits of participation in PA are acknowledged, the vast majority of research has focused on the physical health benefits of participation in PA, with less research focused on the mental and social health aspects. Although mental health benefits have been referenced in recent guidelines, to date "insufficient evidence precludes conclusions about the minimal or optimal types or amounts of physical activity for mental health". Even though the World Health Organisation definition of health (2006) incorporates physical, mental and social health domains, the research providing evidence to the PA guidelines does not specifically address social health. However, the literature informing PA guidelines does suggest that aspects such as social support, may contribute to some of the explanations of mental health outcomes. Leisure-time PA is one domain of PA. Sport is one type of leisure-time PA which is organised and usually competitive and played in a team or as an individual.

Participation in sport is very popular among children. There is evidence, however, that participation in sport peaks at around 11–13 years before declining through adolescence. Conversely, there is research indicating that children who are active through sport are more likely to be physically active in adulthood than those who do not participate in childhood sport. Furthermore, substantial public investment in sport development has been justified in terms of a range of health benefits, but without a clear understanding of the best way to achieve maximum health benefits - either mental or physical. Extensive research has been conducted on the determinants of participation in PA and on interventions that attempt to increase PA participation, with relatively little research focusing more specifically on sport. Also, with regard to the health benefits of PA, the research has generally not extended to the mental and social health benefits of sport participation in particular.

A conceptual model in the public health area has been defined as "diagram of proposed causal linkages among a set of concepts believed to be related to a specific public health problem". Determinants of PA are increasingly being understood using socio-ecological models, whereby intrapersonal, interpersonal, organisational, environmental and policy variables are identified as influences on participation. As Earp and Ennett (1991) explain, conceptual models in health do take an ecological perspective, implying that behaviours or health outcomes result from the interaction of both individual and environmental determinants. In terms of the sport and health nexus, we are not aware of a conceptual model that depicts the specific mental and social health outcomes of sport participation. Conceptual models have been developed which show the relationship between different types of PA, including sport, and the intensity and context of participation, however they do not extend to the health benefits of participation. In one systematic review of the effectiveness of interventions to increase

physical activity, a conceptual model of the relationship between interventions, modifiable determinants, immediate outcomes and health outcomes was developed. This study did not specifically identify sport, however. Furthermore, there are many clinical conceptual models depicting health outcomes of clinical conditions, however they do not focus on the general population or on preventive health or health promotion.
Firstly, this paper presents the results of a systematic review investigating the psychological and social benefits of participation in sport for children and adolescents. Secondly, the information obtained in the systematic review has been used to develop a conceptual model: the conceptual model of Health through Sport, for children and adolescents.

2. AIMS

The main aim of this project is to promote voluntary activities in sport, together with social inclusion, equal opportunities and awareness of the importance of health-enhancing physical activity through increased participation in, and equal access to, sport for all.
The common needs of the protagonist (Vet Organisations, Students and Young people) of these projects are connected with some aims of the European Year of Education through Sport, in particular:

- to make educational institutions and sports organisations aware of the need for cooperation in order to develop education through sport and its European dimension, given the very great interest that young people take in all kind of sports;
- to take advantage of the values conveyed through sport to develop knowledge and skills whereby young people, in particular, can develop their physical prowess and readiness for personal effort and also social abilities such as teamwork, solidarity, tolerance and fair play in a multicultural framework;
- to encourage the exchange of good practice concerning the role sport can play in education systems to promote the social inclusion of disadvantaged groups;
- to create a better balance between intellectual and physical activity in school life by encouraging sport in school activities.

Some others are in continuity with some recommendations of WHITE PAPER ON SPORT, especially:

- enhancing the role of sport in education and training ("Through its role in formal and non-formal education, sport reinforces Europe's human capital. The values conveyed through sport help develop knowledge, motivation, skills and readiness for personal effort. Time spent in sport activities at school and at university produces health and education benefits which need to be enhanced. Based on experience gained during the 2004 European Year of Education through Sport, the Commission encourages support for sport and physical activity through various policy initiatives in the field of education and training, including the development of social and civic competences in accordance with the 2006 Recommendation on key competences for lifelong learning");
- promoting volunteering and active citizenship through sport ("Volunteering in sport organisations provides many occasions for non-formal education which need to be recognised and enhanced. Sport also provides attractive possibilities for young people's engagement and involvement in society and may have a beneficial effect in helping people steer away from delinquency");
- using the potential of sport for social inclusion, integration and equal opportunities ("Sport promotes a shared sense of belonging and participation and may therefore also be an important tool for the integration of immigrants").

Some other aims, finally, are specific for the institutions that take part in the partnership:

- to promote, between the young involved in VET, voluntary activities in sport, together with social inclusion, equal opportunities and awareness of the importance of health-enhancing physical activities, through increased participation in, and equal access to sport for all;
- to develop training modules, learning kits and common methodologies on different themes (and created by multidisciplinary teams in different countries involved) aimed to strengthen education to healthy lifestyles (sport as physical activity for health and primary prevention), combating doping, sensitise on the value of sport and physical activity for personal,

social and professional development as well as for the prevention of violence, intolerance and racism within sports and through sports.

Concerning the 3 educational kit, we will mainly focus on the Kit Brain, Heart&Sport that have the following aims:

- sensory, intellectual and hand-eye coordination;
- conditional capacity building: flexibility, balance, joint mobility and precision;
- team Spirit: sacrifice for the team;
- be aware of their body and the psychological well-being;
- promote the adoption of correct postural behaviours.

3. FOCUS ON THE SOUL

3.1 Introduction

There are many good reasons to learn about the brain. The brain is a spongy, three pound mass of fatty tissue and has been compared to a supercomputer. But the brain is much more complicated than any device, a fact scientists confirm almost daily with each new discovery. The extent of the brain's capabilities is unknown, but it is the most complex living structure known in the universe.

Our brain controls all body activities, ranging from heart rate and sleep to emotion, learning and memory. It is even thought to influence our thoughts, hopes, dreams and imagination. In short, the brain is what makes us human[1].
The human body is made up of trillions of cells. Cells in the nervous system act as our body's communication system, sending information from place to place to coordinate your body's actions. The nervous system has two main types of cells: nerve cells, called *neurons*, and *glial cells*.

Neuron

The brain is what it is because of the structural and functional properties of neurons, the basic working unit of the brain. They are specialised cells designed to transmit information to other nerve cells, muscle or gland cells. The human brain has approximately 100 billion neurons.
Neurons have a unique shape that is very different from the shape of the other cells in the body, and this shape perfectly suits their job: transmitting signals known as impulses around the body. The signal moves only in one direction along neurons. It travels from the cell body containing the nucleus, down an electricity-conducting fiber, the *axon*, which also gives rise to many smaller axon branches before ending at nerve terminals.
Other cell processes, *dendrites*, Greek for the branches of a tree, extend from the neuron cell body and receive messages from other neurons.
Neurons have a variety of shapes and sizes. Some neurons are very short (less than a millimeter in length) and some neurons are very long (1 metre or more). For example, the axon of a neuron stretching from the spinal cord to a muscle in the foot can be more than 1 metre in length.

How do neurons send messages?

Synapses, from the Greek words meaning to "clasp together," are the contact points where one neuron communicates with another. Synapses puzzled scientists for years. They knew that synapses were the places where "messages" passed from one neuron to the next, but they could also see, using powerful microscopes, that neurons do not touch each other at synapses[2]. Neurons are very close to each other, but are always separated by a small space called the synaptic cleft.
If the cells do not touch each other, how is the nerve signal transmitted? The answer to this puzzle is *neurotransmitters*, chemical messengers that are released at nerve ending terminals and bind to receptors on the surface of the target neuron. These receptors act as on and off switches for the next cell. Each receptor has a distinctly shaped part that exactly matches a

1 The Society of Neuroscience, Brain Facts. A primer on the brain and nervous system, 2002.

2 Eric H. Chudler, Inside your brain, Infobase Publishing, 2007.

particular chemical messenger. This action is similar to a lock and key: the key (the neurotransmitter) must fit the lock (the receptor).
Two different types of synapse, electrical and chemical, can be distinguished on the basis of their mechanism of transmission. At electrical synapses, current flows through gap junctions, which are specialized membrane channels that connect two cells. In contrast, chemical synapses enable cell-to-cell communication via the secretion of neurotransmitters, chemical agents that produce secondary current flow in postsynaptic neurons by activating specific receptor molecules.

Glial cells are Support cells

Although there are approximately 100 billion neurons in the brain, there are between 10 and 50 times that many *glial cells* in the brain. In actuality, glia do not commonly hold nerve cells together. Rather, they surround the cell bodies, axons, and dendrites of neurons. Glia are not directly involved in information processing, but they are thought to have other vital roles, for example, to provide physical and nutritional support for neurons, clean up dead brain cells, and provide the insulation for neurons.
Two types of glial cells (oligodendrocytes and Schwann cells) produce the myelin used to insulate nerve cell axons, the cell outgrowths that conduct electrical signals[3].

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Neurotransmitters

Acetylcholine

The first neurotransmitter to be identified 70 years ago, was *Acetylcholine (ACh)*. This chemical is released by neurons connected to voluntary muscles, causing them to contract, and by neurons that control the heartbeat. ACh also serves as a transmitter in many regions of the brain. Recent discoveries suggest that it may be critical for normal attention, memory and sleep. Deficiency in the brain may be associated with Alzheimer's disease. Deficiency outside the brain can lead to paralysis and death.

Dopamine

Dopamine is present in several brain regions, although the major dopamine-containing area of the brain is the *corpus striatum*, which receives major input from the substantia nigra and plays an essential role in the coordination of body movements. In Parkinson's disease, for instance, the dopaminergic neurons of the substantia nigra degenerate, leading to a characteristic motor dysfunction, like muscle tremors, rigidity and difficulty in moving. Another dopamine circuit is thought to be important for cognition and emotion. Abnormalities in this system have been implicated in schizophrenia. Finally, Dopamine is also believed to be involved in motivation, reward, and reinforcement, and many abusive drugs work by affecting dopaminergic synapses in the Central Nervous System.

Glutamate

Glutamate is the most important transmitter in normal brain function. Nearly all *excitatory* neurons in the central nervous system are glutamatergic, and it is estimated that over half of all brain synapses release this agent. Glutamate plays an especially important role in clinical neurology because elevated concentrations of extracellular glutamate, released as a result of neural injury, are toxic to neurons. In addition, this toxicity may contribute to chronic degenerative diseases of the brain, such as Huntington disease.

3 Eric R. Kandel et al., Principles of neural science, The McGraw-Hill Companies, 2013.

GABA

GABA was identified in brain tissue during the 1950s. It is a major *inhibitory* transmitter in the brain and spinal cord. The activity of GABA is increased by benzodiazepine (Valium) and by anticonvulsant drugs. In Huntington's disease, a hereditary disorder that begins during mid-life, the GABA-producing neurons in the brain centers coordinating movement degenerate, thereby causing incontrollable movements.

Norepinephrine

Nerve fibers containing norepinephrine are present throughout the brain. Deficiencies in this transmitter occur in patients with Alzheimer's disease, Parkinson's disease and those with Korsakoff's syndrome, a cognitive disorder associated with chronic alcoholism. Researchers thus believe norepinephrine may play a role in both learning and memory. Norepinephrine also is secreted by the sympathetic nervous system in the periphery to regulate heart rate and blood pressure. Acute stress increases the release of norepinephrine and also it is activated in states of heightened danger.

Serotonin

Sometimes called the "feel good" chemical, this neurotransmitter is present in many tissues, particularly blood platelets and the lining of the digestive tract and the brain. Serotonin was first thought to be involved in high blood pressure because it is present in blood and induces a very powerful contraction of smooth muscles. In the brain, it has been implicated in sleep, mood, depression and anxiety. The level of serotonin is thought to be reduced in depressive illness. In this sense, serotonin occupies a place of prominence in neuropharmacology because a large number of antipsychotic drugs that are valuable in the treatment of depression and anxiety act on serotonergic pathways.

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The Society of Neuroscience, *Brain Facts. A primer on the brain and nervous system*, 2002

Structure and Anatomy of the Brain

The brain as a whole is divided into two halves, the left and right cerebral *hemispheres*. Each cerebral hemisphere consists of surface grey matter (the cortex), inner white matter, and a number of gray matter subcortical regions.
Surface gray matter can be further divided into four lobes. The *frontal lobe* is comprised of the motor cortex, which is central to voluntary movement, and the prefrontal region, which is central to higher-order thinking and executive functions such as strategizing and planning. The parietal lobe primarily serves the functions of touch sensation and spatial thinking. The *temporal lobe* is involved in language reception, auditory perception, memory, and a number of social cognitive functions. The *occipital* lobe is central to vision[4].

What's Gray Matter?

The surface *gray matter* is where the brain processing takes place. Gray matter is made up of the cell bodies of neurons, the nerve fibres that project from them, and support cells[5]. Imaging studies of the human brain have demonstrated that the volume of cortical gray matter follows an inverted U-shaped trajectory across development. During childhood, regional gray matter increases in volume, peaks in late childhood or early adolescence, and then begins to

4 Jetha Michelle K., Segalowitz Sidney J., *Adolescent Brain Development. Implications for behavior,* Elsevier, 2012.

5 NIMH, National Institute of Mental Health, *The Teen Brain: still under construction,* 2011.

decline in volume into early adulthood[6]. A notable surge in thickening occurs just before the onset of puberty (at 11 years in girls and 12 years in boys, on average)[7].

The thinning of gray matter results from several factors. These include the pruning of synapses, axons, and dendrites or a reduction in glial cells. Actually, the role of this decline is very positive, because it is viewed as a reliable marker of maturation, a period of shaping and *rewiring* of the synapses that is sensitive to environmental influences. Overall, gray matter maturation proceeds in a back-to-front direction, occurring first in areas toward the back of the brain that receive information from the senses (vision, hearing, and touch), then in regions involved in spatial orientation and language, and finally in regions with more advanced functioning such as those that integrate sensory information coming from multiple brain regions, called *association regions*. Association regions located in the frontal lobes, for example, the lateral prefrontal cortices, are among the last to mature during adolescence[8].

What's White Matter?

The *white matter* provides the connectivity or wiring between regions. White matter volume begins to increase early in the postnatal period and continues over childhood, adolescence, and into middle adulthood, with some studies showing peak volume in the middle of the fifth decade of life[9]. The maturation of white matter organization proceeds at different rates in different regions. Some regions are mature by adolescence and others are still maturing into young adulthood, particularly those linking the frontal and parietal regions[10]. The largest white matter tract is the corpus callosum. It allows for integration of information across the two sides of the brain and thickens considerably from 4 to 22 years[11].

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The Triune Brain Theory

In 1969 Paul MacLean proposed an evolutionary theory of brain development called the Triune Brain Theory. This theory suggests that the human brain is actually composed of three brains that appeared at different stages in our evolution: the reptilian brain, which includes the brain stem and cerebellum, is the oldest; the limbic system, or the old mammalian brain, came next; and the neocortex, or the neomammalian brain, emerged most recently. Each of these areas is separate, but they do not function independently.
The *reptilian brain* developed about 500 million years ago. It is responsible for body functions needed for survival, such as heart rate and breathing. This ancient brain also determines our level of alertness.

The *limbic system* was the second part of our brain to develop, about 250 million years ago. Since it corresponds to the brain of most mammals, it is often referred to as the mammalian brain. The key components of the limbic system are the amygdala, hippocampus, thalamus, and hypothalamus. This section of our brain is known primarily as the seat of our emotions.

6 For an idea of the complexity of the brain: a cube of brain matter, 1 millimetre on each side, can contain between 35 and 70 million neurons and an estimated 500 billion synapses.

7 Giedd JN, Snell JW, Lange N et al., *Quantitative magnetic resonance imaging of human brain development: ages 4–18,* Cerebral Cortex 6, 551–560, 1996.

8 Jetha Michelle K., Segalowitz Sidney J., *Adolescent Brain Development. Implications for behavior,* Elsevier, 2012.

9 Paus T, Collins DL, Evans AC et al., *Maturation of white matter in the human brain: a review of magnetic resonance studies,* Brain Res Bull 54, 255–266, 2001.

10 Asato MR, Terwilliger R, Woo J et al., White matter development in adolescence: A DTI study, Cerebral Cortex 20, 2122–2131, 2010.

11 Luders E, Thompson PM, Narr KL et al., The link between callosal thickness and intelligence in healthy children and adolescents, Neuroimage 54, 1823–1830, 2011.

The limbic system is also responsible for regulating our appetite, sexual urges, sleeping, hormones, and our immune system.

Our neocortex, which is the outer part of the cerebrum, and the last part of the brain to develop, about 200 million years ago, makes up about 85 percent of the human brain. Reptiles do not have a neocortex and other mammals have only a small one. Our highly developed neocortex is the part of the brain that makes us human. It allows us to reflect, to plan, and to make goals. The neocortex integrates information from the limbic system and the brain stem to plan, make decisions, and help us move.

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3.2 The "Visible" Brain

The brain is much more than an anatomical structure; it is also an active processing center, always at work. There are three relevant and essential features that characterise our brain features:

- **adaptability.** The brain changes constantly.
- **integration.** Brain structures compete and cooperate.
- **sophistication.** The brain is highly complex.

These themes help to establish the nature of the brain: it is constantly working; it operates with a high level of structural cooperation; and seemingly simple processes, like learning to read, are actually highly complex. This dynamic and versatile structure is unlike anything else on Earth[12].

Adaptability. The changing Brain

Our brains have a quality called "*neuroplasticity*", which is the ability to learn and adapt (or relearn) through the creation of new connections. Neuroplasticity is built into the human brain, giving it a remarkable capacity to reorganise itself, to make brain wiring more efficient, and to find compensatory neural pathways if there is a brain injury of some kind.
It's now understood that environmental events at one level of an organism (molecules, cells, organs, systems, individual behavior, society) can profoundly influence events at other levels[13]. This finding suggests that our experiences and the actions we take can lead to changes in our brain. Inside our brain, cells are being eliminated at the same time new cells are being born. We lose some brain cells every day through attrition, decay, and disuse, and we know that certain behaviors or situations affect the loss of brain cells. Now we know that environmental triggers, even things like stress[14], can "reprogram" our genes. Some of the most interesting recent research on the brain's adaptability shows how activities can influence the

12 Jensen E., *Teaching with the brain in mind,* Association for Supervision and Curriculum Development (ASCD), 2005.

13 Cacioppo J., Berntson G., Sheridan J., McClintock M., *Multilevel analyses of human behavior: Social neuroscience and the complementing nature of social and biological approaches.* In J. Cacioppo (Ed.), Foundations in social neuroscience (pp. 21–46), Cambridge, MA: MIT Press, 2001.

14 Foster P.L., Cairns J., *The occurrence of heritable Mu excisions in starving cells of Escherichia coli,* The EMBO Journal, 13(21), 5240– 5244, 1994.

actual mass and organization of the brain. For example, playing a musical instrument consistently over time can literally remap the brain. One study found that the cerebellum, the brain structure that contains almost half of the brain's neurons, was 5 percent larger in musicians than in the general population[15].
This constant reorganization of the brain is always purposeful, driven not by a mysterious signal but by real-life use and disuse.

Integration.
Cooperation and Competition inside the Brain

How does our brain cooperate with itself? Brain cells are connected to other brain cells by physical structures such as axons, which are extensions sent out by neurons. Brain areas and structures can communicate via glial cells too. And certainly the bloodstream creates a common network, circulating neurotransmitters and hormones. The two sides of the brain, the left and right cerebral hemispheres, are connected by bundles of nerve fibres. The *corpus callosum* is the largest of these connective pathways, with about 250 million nerve fibres. Discoveries in cognitive neuroscience have shown many nuances in the left and right brain preferences. For example, Richard Davidson at the Laboratory for Affective Neuroscience at the University of Wisconsin has shown that the right hemisphere is activated with negative emotions and the left hemisphere is activated with positive emotions[16].
What about the competition within the brain? The competition concept is simple: whatever is first, whatever activities are more frequent, and whatever actions are more coherent, will "win" the competition for network wiring, and signal the brain to allocate space and resources to that set of behaviors. This is possible because humans have so much uncommitted brain tissue at birth, and our brains have an extraordinary opportunity to become customized by life experiences.

Sophistication.
How the brain learns

Learning new content, like a new sports or exercise, is a very complex process. It involves groups of neurons, or neural networks. One neuron is able to forge connections with up to 10 thousand other neurons. Along these passageways, messages can travel at speeds of up to 200 km/h!
But how do we create new neural passageways in the brain? When we first learn something new, it is slow going, similar to cutting a path for the first time in a large, dense forest. As we travel over the path time and time again, the same neurons are activated over and over. Essentially, we go from cutting the initial path through the forest to driving on a neural superhighway[17]. Training during sport is necessary for building this pathway and it helps us to become better players.
Inside the brain, several conditions show that learning has taken place:

- **modification of existing connections.** The connections are strengthened, weakened, or reprogrammed to new neurons;
- **elimination of synapses.** Synapses are eliminated through pruning and experience. What we don't use is usually eliminated in the competitive neural world;
- **growth of new connections.** This process, called synaptogenesis, is typically the result of new learning.

15 Gaser C., Schlaug G., *Brain structures differ between musicians and non-musicians,* Journal of Neuroscience, 23(27), 9240–9245, 2003.

16 Jensen E., *Teaching with the brain in mind,* Association for Supervision and Curriculum Development (ASCD), 2005.

17 Connell Diane J., Brain-based strategies to reach every learner, Scholastic teaching resources, 2005.

Although synapses are certainly key players, learning is far more complex. Researchers also now know that learning is not simply stored at the synapse. If that were the case, activation of a particular synapse would always activate a particular memory. Other factors come into play, and the brain's enormous sophistication begins to reveal itself. Even with the learning stored properly, only the right "state activations" (meaning the right neuronal assemblies) and the appropriate chemical mix will retrieve the learning. Whole-body states activate these networks. When we are in a clear-thinking, good state for learning, we learn and recall more than when we are depressed, tired or angry[18].

3.3 Myths and Truths about the Brain

Enthusiasm for research on the brain and its application in many fields, like education, is growing among experts. However, a lack of sufficient knowledge and poor communication, has led to the proliferation of numerous 'neuromyths'. It is an issue which concerns the rapid increase of several misconceptions about the mind and the brain, that causes misinterpretation and oversimplification of scientific research[19]. Here are some of the myths and truths about the brain.

We Only Use 10% of Our Brain (Myth)

Is this true? Do we only use a very small portion of our brain? Today, neuroscientists dismiss this idea, and they have evidence to prove it is a myth. Evidence shows that all parts of the brain function, not just 10%. One of the strongest pieces of evidence comes from imaging the active brain. When scientists scan the brain using brain imaging techniques, they see that much of the brain is active when it is performing many different tasks. The scans also show that during particular tasks, some areas are more active than others[20]. The statement that we use only 10% or our brain is a myth. We use all of our brain as we go through the different mental and physical activities we perform every day, including sleep.

The Human Brain Compensates for Missing Sensors (Truth)

Is it true that after losing a sense the brain tries to compensate? For example, people say that blind individuals hear better than sighted people. Scientists agree that the loss of one sense prompts the brain to use the other senses better. However, scientists still disagree on how this happens. Some scientists think that blind people develop a more sensitive sense of hearing than sighted people. Other scientists say that blind and sighted people are able to detect the same sounds, but blind people have learned to pay better attention to those sounds that are the hardest to hear. Either way, it is true that after losing a sense the brain will make better use of the other senses.

The Brain Works on the Principle of "Use It or Lose It" (Truth)

If the brain does not "exercise" or receive the necessary input from the environment to develop a particular ability, then that ability will be lost. This is truth especially during adolescence. Many studies have applied brain imaging techniques and reveal that the grey matter thickens in childhood but then thins in a wave that begins at the back of the brain and reaches the front by early adulthood. The process completes itself sooner in girls than in boys. The grey-matter

18 Jensen, E., *Teaching with the brain in mind,* Association for Supervision and Curriculum Development (ASCD), 2005.

19 Ferrero M. et al., *Neuromyths in education: Prevalence among Spanish teachers and an exploration of cross-cultural variation,* Frontiers in Human Neuroscience, 2016.

20 A. M. Rodriguez, *A day in the life of the brain,* Infobase Publishing, 2007.

thinning seen during adolescence is probably due to *synaptic pruning*, the process of eliminating overabundant, unnecessary nerve cell connections, depending of environmental input which guide that pruning. If synaptic pruning is accelerated during adolescence, it follows that this is a time of 'use it or lose it' in the brain. Therefore, teens should be exposed to rich environments full of sports, travel, music and foreign languages[21], for making a better brain.

Brain Damage is Always Forever (Myth)

For many years, scientists believed that the brain lacked the ability to fix itself. Scientists thought that once you lost neurons, the function they coordinated, such as speech or movement, would be permanently affected. This idea has changed. Scientists have discovered that sometimes the brain is capable of recovering lost functions. Some patients who had lost their ability to move their right arm after damage to the left hemisphere of the brain did recover the use of their arm, at least part of it, after physical therapy or exercise. Doctors studied the patients' brains and discovered that their brains had changed. Therapy and exercise stimulated the brain to use healthy neurons around the site of injury to rewire the lost connections between the arm and the brain[22]. Today, we know that the brain has the ability to rewire its neural connections. It does it in response to external stimuli, both physical (such as swimming) and mental (such as learning volleyball rules). However, when the damage to the brain is too severe, rewiring might not be enough to recover the lost function.

Brain Cells Cannot Multiply and Make New Cells (Myth)

Until the 1990s, scientist thought that neurons could not divide or reproduce to make new neurons that would replace old, damaged, or dead neurons. They thought that other cells in the body were able to reproduce, but not neurons. That meant that once a neuron died, it would never be replaced with a new cell. Fortunately, scientists were wrong, there are neurons in the brain that can reproduce. This very important discovery has changed the way scientists think about the brain. The brain is no longer viewed as an unchanging organ, but one that is flexible and capable of changing itself.

The Brain is "Hard-wired" From the Time we are Born (Myth)

The brain was described like an essential organ that was "hard-wired" from the time of birth. This meant that the way the billions of neurons were connected to each other, the circuits they formed by the time we were born, would not change throughout life. This static or fixed view of the brain has changed radically. When a baby is born, there are few neurons in the cortex, but after three months the number of dendrites or cell projections emerging from the bodies and axons of neurons has multiplied enormously. The processes of sprouting dendrites and establishing synapses (cell-to-cell connections) grow at a tremendous pace. The result is that when the baby is two years old, the cortex is much thicker than just after birth and the neural connections or circuits are massively more complex. This process never stops. As we grow up and enter adulthood, the process continues at a much slower pace, and it happens always during learning new things, like sports.

3.4 A Spectrum of Change

Research using many different approaches is showing that more than gray matter is changing:

21 K. Powell, H*ow does the teenage brain work*, Nature Vol 442, 2006.

22 A. M. Rodriguez, *A day in the life of the brain,* Infobase Publishing, 2007.

- connections between different parts of the brain increase throughout childhood and well into adulthood. As the brain develops, the fibers connecting nerve cells are wrapped in a protein that greatly increases the speed with which they can transmit impulses from cell to cell. The resulting increase in connectivity—a little like providing a growing city with a fast, integrated communication system—shapes how well different parts of the brain work in tandem. Research is finding that the extent of connectivity is related to growth in intellectual capacities such as memory and reading ability;
- several lines of evidence suggest that the brain circuitry involved in emotional responses changes during the teen years. Functional brain imaging studies, for example, suggest that the responses of teens to emotionally loaded images and situations are heightened relative to younger children and adults. The brain changes underlying these patterns involve brain centres and signaling molecules that are part of the reward system with which the brain motivates behaviour. These age-related changes shape how much different parts of the brain are activated in response to experience, and in terms of behaviour, the urgency and intensity of emotional reactions;
- enormous hormonal changes take place during adolescence. Reproductive hormones shape not only sex-related growth and behaviour, but overall social behaviour. Hormone systems involved in the brain's response to stress are also changing during the teens. As with reproductive hormones, stress hormones can have complex effects on the brain, and as a result, behaviour;
- in terms of sheer intellectual power, the brain of an adolescent is a match for an adult's. The capacity of a person to learn will never be greater than during adolescence. At the same time, behavioral tests, sometimes combined with functional brain imaging, suggest differences in how adolescents and adults carry out mental tasks. Adolescents and adults seem to engage different parts of the brain to different extents during tests requiring calculation and impulse control, or in reaction to emotional content;
- research suggests that adolescence brings with it brain-based changes in the regulation of sleep that may contribute to teens' tendency to stay up late at night. Along with the obvious effects of sleep deprivation, such as fatigue and difficulty maintaining attention, inadequate sleep is a powerful contributor to irritability and depression. Studies of children and adolescents have found that sleep deprivation can increase impulsive behaviour; some researchers report finding that it is a factor in delinquency. Adequate sleep is central to physical and emotional health.

3.5 How Adolescent Brain Works

Understanding how the brain of an adolescent is changing may help explain a puzzling contradiction of adolescence: young people at this age are close to a lifelong peak of physical health, strength, and mental capacity, and yet, for some, this can be a hazardous age. Mortality rates jump between early and late adolescence. Despite being thought of as a healthy period of life, there is significant death and disease during the adolescent years. Last survey of WHO in 2012, estimated that 1.3 million adolescents died, down from 1.5 million in 2000. The leading causes of death among adolescents in 2012 were road injury, HIV, suicide, lower respiratory infections and interpersonal violence[23]. Rates of death by injury between ages 15 to 19 are about six times that of the rate between ages 10 and 14. Crime rates are highest among young males and rates of alcohol abuse are high relative to other ages[24]. Even though most adolescents come through this transitional age well, it's important to understand the risk factors for behavior that can have serious consequences. The more we learn, the better

23 WHO, Global Health Estimates, 2012.

24 National Institute of Mental Health, *The teen brain: still under construction,* 2011.

we may be able to understand the abilities and vulnerabilities of teens, and the significance of this stage for life-long mental health.

Developmental changes in connectivity and dynamic networks

Everyday experience of adults who live or work with teens is often that of exasperation. Teens often make bad choices and then lie to cover them up. In some cases, the average 9-year-old can make a better decision than an adolescent can. The traditional explanation has been "it's hormones". But neuroscience says that hormones are only partly responsible. The rapid and massive structural change occurring in the brain during the teen years is actually the biggest reason for often-bizarre teen behavior[25].

The knowledge that adolescence is a time of profound brain growth and change is contrary to ideas that the brain was mostly fully mature by the end of childhood. In the earliest stages of brain development, primarily before birth, there are many more brain cells and connections formed than can possibly survive. A process of competitive elimination, or *pruning*, follows this vast overproduction. This process occurs in all species possessing a central nervous system. In humans, a second span of overproduction of connections occurs just before puberty, followed by "*use-it-or-lose-it*"[26] pruning through the teen years, as connections are shaped and refined. These changes have important implications for a teen's ability to become an independent and successful adult, capable to manage impulses and reject temptations for planning long-term goals[27].

Pruning during adolescence is highly specific and can be pronounced, resulting in a loss of approximately 50% of the synaptic connections in some regions, but with little decline in others[28]. Pruning has been speculated to help with the rewiring of brain connections into adult typical patterns, and declines in the numbers of synapses likely contribute to the increases in brain efficiency seen during adolescence[29].

In addition to the loss of many synapses, there is also a growth and elaboration of other neuronal connections, especially those that connect regions of the cortex to one another. As the brain matures, the strategies for handling complex environmental information change. The brain stores and processes information in different regions, largely according to the nature of the information (for example, visual or auditory data). To take on this new challenge, the brain grows more efficient circuits that can process multiple steams of information in parallel, like a sophisticated computer that uses multiple processors[30]. This increased information sharing is reflected in the patterns of connections between and among neurons in different regions of the cortex. For example, the branching of neurons in the prefrontal cortex becomes much more complex during adolescence, likely reflecting a more intricate web of information flow[31].

25 Siegel D., *Brainstorm: The Power and Purpose of the Teenage Brain,* New York Tarcher/Penguin Publishers, 2013.

26 Cells and connections that are used survive, those that aren't used wither.

27 Daniel R. Weinberger, Brita Elvevåg, Jay N. Giedd, *The Adolescent Brain: A Work in Progress,* The National Campaign to prevent teen pregnancy, June 2005.

28 Spear L.P., *Adolescent Neurodevelopment,* Journal of Adolescent Health (52) S7–S13, 2013.

29 Chugani H.T., Neuroimaging of developmental nonlinearity and developmental pathologies, In: Thatcher RW, Lyon G.R., Rumsey J., Krasnegor N., eds., *Developmental Neuroimaging: Mapping the Development of Brain and Behavior,* San Diego, CA: Academic Press, 187–95, 1996

30 Daniel R. Weinberger, Brita Elvevåg, Jay N. Giedd, *The Adolescent Brain: A Work in Progress,* The National Campaign to prevent teen pregnancy, June 2005.

31 Lambe, Krimer, & Goldman-Rakic, *Differential postnatal development of catecholamine and serotonin inputs to identified neurons in prefrontal cortex of rhesus monkey,* Journal of Neuroscience, Dec 1;20(23):8780-7, 2000.

Prefrontal areas, still under construction

On a gross anatomical level, most areas of the brain are under major construction during adolescence. The parietal lobes undergo major changes, with areas doubling or tripling in size. Between childhood and adulthood, the brain's *wiring diagram* becomes richer, more complex and more efficient, especially in the brain's frontal lobe, which is the seat of such higher order functions as learning and socialization. An important part of the frontal lobes is the prefrontal cortex (PFC), which is often referred to as the "CEO" or executive of the brain and is responsible for such skills as setting priorities, organizing plans and ideas, forming strategies, controlling impulses, and allocating attention[32]. New research suggests that the PFC is one of the last areas of the brain to fully mature, around 25 years old. Evidence for delayed maturation of frontal regions is evident in terms of cortical thinning[33], due to a decrease in the number and thickness of branches and connections on the dendrites and axons of the existing neurons.
Development of frontal regions into late adolescence/early adulthood is thought to result in relatively late maturation of top-down control systems that gradually strengthen their control over early emerging, largely subcortical bottom-up systems that are highly responsive to rewarding and emotional stimuli[34].
In fact, in addition to changes of the cerebral cortex, lower centres of the brain also undergo changes in their connection patterns during adolescence. Three areas that have been of particular interest in understanding aspects of impulse control and judgment are the hippocampus, the caudate nucleus, and the amygdala. The hippocampus is critical to the formation of new memories. The caudate nucleus is a relay station for information destined for the prefrontal cortex, and seems to be important for learning to make certain behavioral routines more or less automatic. The amygdala processes emotional information, especially the experience of fear, danger and threat in the environment.

SCHEDA

The Strange case of Phineas Gage

Adults whose frontal lobes are damaged often lack inhibitory control, so they tend to be uninhibited and impulsive. The classic example is the story of Phineas Gage, a 25-year-old Vermont railroad foreman who suffered a brain injury in l848. While packing down blasting powder, he inadvertently sparked an explosion that sent a tamping iron rocketing through the bottom of his left cheek bone and out through the top of his head. To the amazement of his co-workers, Gage only briefly lost consciousness and stood up and spoke moments later. Physically, Gage recovered well enough so that within a few months he was able to walk, speak, and demonstrate normal awareness of his surroundings. He lived for another 13 years, but his character was never the same. The formerly diligent, responsible foreman became a person who was extremely impulsive, ill mannered and unable to follow through on his obligations. "Gage was no longer Gage," said one of his friends.

Changes in chemical level: the brain reward circuitry and the role of dopamine

On the chemical level, the teen brain is influenced by unstable levels of the feel-good neurotransmitter dopamine. Some researchers argue that dopamine levels are too low during adolescence, and others argue that dopamine levels are actually very high during this time

32 Daniel R. Weinberger, Brita Elvevåg, Jay N. Giedd, *The Adolescent Brain: A Work in Progress,* The National Campaign to prevent teen pregnancy, June 2005.

33 Gogtay N., Giedd J.N., Lusk L., et al., *Dynamic mapping of human cortical development during childhood through early adulthood,* PNAS, 101:8174–9, 2004.

34 Casey B.J., Getz S., Galvan A., *The adolescent brain*, Developmental Review, 28:62–77, 2008.

frame[35]. In either case, the teen brain is more sensitive to the pleasurable effects of some activities, like drugs consumption or nicotine or alcohol, for example, that activate dopamine levels. Moreover, novel stimuli, exciting and risky situations, and alcohol, nicotine, and other drugs of potential abuse tap into complex and ancient brain reward circuitry that is critical for seeking, finding, and "consuming" survival-essential natural rewards such as food, water, warmth, sexual partners, and other social stimuli[36]. Dopamine is involved in this reward circuitry.
This chemical has been found to be critical also for focusing attention on environmental stimuli when it is necessary to chose between conflicting options, especially when the goal may not be obvious and choices based on memory, not impulse, are required. Since learning is based on reward, the adolescent begins to have the ability to follow an idea in pursuit of a goal, rather than to simply act on instinct.

Scientists continue to investigate the development of the brain and the relationship between the changes taking place, behavior, and health. The following questions are among the important ones that are targets of research:

- how do experience and environment interact with genetic preprogramming to shape the maturing brain, and as a result, future abilities and behavior? In other words, to what extent does what a teen does and learns shape his or her brain over the rest of a lifetime?
- In what ways do features unique to the teen brain play a role in the high rates of illicit substance use and alcohol abuse in the late teen to young adult years? Does the adolescent capacity for learning make this a stage of particular vulnerability to addiction?
- Why is it so often the case that, for many mental disorders, symptoms first emerge during adolescence and young adulthood?

This last question has been the central reason to study brain development from infancy to adulthood. Scientists increasingly view mental illnesses as developmental disorders that have their roots in the processes involved in how the brain matures. By studying how the circuitry of the brain develops, scientists hope to identify when and for what reasons development goes off track. Brain imaging studies have revealed distinctive variations in growth patterns of brain tissue in youth who show signs of conditions affecting mental health. Ongoing research is providing information on how genetic factors increase or reduce vulnerability to mental illness; and how experiences during infancy, childhood, and adolescence can increase the risk of mental illness or protect against it.

SCHEDA
Brain Imaging Techniques

The recent advances in understanding the brain are due to the development of techniques that allow scientists to directly monitor brain activity.

Magnetic Resonance Imaging (MRI)

MRI is based on the fact that the nuclei of some atoms act as spinning magnets, and that if they are placed in a strong magnetic field they will line up with the field and spin at a frequency that is dependent on the field strength. If they then receive a brief radiofrequency pulse tuned to their spinning frequency they are knocked out of alignment with the field, and subsequently emit energy in an oscillatory fashion as they gradually realign themselves with the field. The strong magnetic field and radiofrequency pulses used in MRI scanning are harmless, making this technique completely noninvasive. Brain structures are clearly visible with this technique, but it does not show anything about brain function.

35 Siegel D., *Brainstorm: The Power and Purpose of the Teenage Brain,* New York Tarcher/Penguin Publishers, 2013.

36 Nesse RM, Berridge KC., *Psychoactive drug use in evolutionary perspective,* Science, 278:63–6, 1997.

Electroencephalogram (EEG)

The EEG records the brain's electrical activity. Electrical signals are detected by a series of electrodes placed on the scalp. These signals are amplified and look like a series of waves when displayed on a monitor or paper chart. The shapes of these waves indicate the brain's activity.

Magnetoencephalography (MEG)

MEG is based on detecting the tiny magnetic pulse emitted in the rapidly changing patterns of brain activity. By combining fMRI (the "where" of brain activity) and MEG (the "when" and "how long" of the activity), researchers can arrive at a much more precise understanding of how the brain works.

Imaging functional variations in the living brain has also become possible with the recent development of techniques for detecting small, localized changes in metabolism or cerebral blood flow. To conserve energy, the brain regulates its blood flow such that active neurons with relatively high metabolic demands receive more blood than relatively inactive neurons. Detecting and mapping these local changes in cerebral blood flow forms the basis for three widely used functional brain imaging techniques: positron emission tomography (PET), single-photon emission computerised tomography (SPECT), and functional magnetic resonance imaging (fMRI).

Positron emission tomography (PET)

In PET scanning, unstable positron emitting isotopes are incorporated into different reagents (including water, precursor molecules of specific neurotransmitters, or glucose) and injected into the bloodstream. Labeled oxygen and glucose quickly accumulate in more metabolically active areas, and labeled transmitter probes are taken up selectively by appropriate regions. As the unstable isotope decays, it results in the emission of two positrons moving in opposite directions.

Single-photon emission computerised tomography (SPECT)

SPECT imaging is similar to PET in that it involves injection or inhalation of a radiolabeled compound, which produce photons that are detected by a gamma camera moving rapidly around the head.

Functional magnetic resonance imaging (fMRI)

Functional MRI, a variant of MRI, currently offers the best approach for visualising brain function based on local metabolism. Whenever there is increased activity in the brain, blood rushes in to provide extra oxygen and glucose for the active brain cells . Because fMRI uses signals intrinsic to the brain without any radioactivity, repeated observations can be made on the same individual.

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4. THE MENTAL BENEFITS OF SPORTS

4.1 Sports Improve Your Mood

Want a burst of happiness and relaxation? Get involved in a physical activity. Whether you are playing sports, working out at a gym, or taking a brisk walk, physical activity triggers brain chemicals that make you feel happier and more relaxed. Team sports in particular provide a chance to unwind and engage in a satisfying challenge that improves your fitness. They also provide social benefits by allowing you to connect with teammates and friends in a recreational setting.

4.2 Sports Improve Your Concentration

Regular physical activity helps keep your key mental skills sharp as you age. This includes sharp thinking, learning, and using good judgment. Research has shown that doing a mix of aerobic and muscle strengthening activities is especially helpful. Participating in this kind of activity three to five times a week for at least 30 minutes can provide these mental health benefits.

Sports Reduce Stress and Depression

When you are physically active, your mind is distracted from daily stressors. This can help avoid getting bogged down by negative thoughts. Exercise reduces the levels of stress hormones in your body. At the same time, it stimulates production of endorphins. These are natural mood lifters that can help keep stress and depression at bay. Endorphins may even leave you feeling more relaxed and optimistic after a hard workout on the field. Experts agree that more quality research is needed to determine the relationship between sports and depression.

4.3 Sports Improve Sleep Habits

Sports and other forms of physical activity improve the quality of sleep. It does this by helping you fall asleep faster and deepening your sleep. Sleeping better can improve your mental outlook the next day, as well as improve your mood. Just be careful not to engage in sports too late in the day. Evening practices within a few hours of bedtime may leave you too energized to sleep.

Sports Help You Maintain a Healthy Weight

The Centres for Disease Control and Prevention (CDC) recommend sports participation as a healthy way to maintain weight. Individual sports, such as running, cycling, and weightlifting, are all particularly effective ways to burn calories. Staying within a recommended weight range reduces the likelihood of developing diabetes, high cholesterol, and hypertension.

4.4
Sports Boost Your Self-Confidence

The regular exercise that comes with playing sports can help boost your confidence and improve your self-esteem. As your strength, skills, and stamina increase through playing sports, your self-image will improve as well. Sports provide you with a sense of mastery and control, which often leads to a feeling of pride and self-confidence. With the renewed vigor and energy that comes from physical activity, you may be more likely to succeed in tasks off the playing field as well as on it.

4.5
Sports Have Been Linked to Leadership Traits

Team sports such as soccer, baseball, and basketball are breeding grounds for leadership traits. Studies done in high schools reveal a correlation between sports participation and leadership qualities. Because of the opportunity to train, try, win, or lose together, people involved in sports are naturally more inclined to adopt a “team mindset” in the workplace and in social situations. The team mindset leads to strong leadership qualities over time.

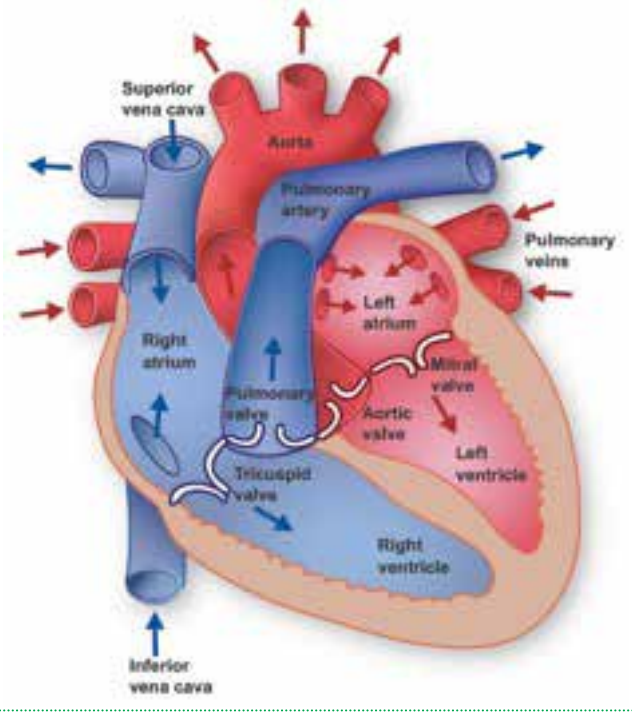
4.6
Benefits for Young Children

Sports can benefit children in many of the same ways that they benefit adults. The biggest difference is that when children start participating in sports at a young age, they are far more likely to stay active as they grow older. The same source suggests that participating in a team sport improves academic performance, leads to better scholastic outcomes, and results in more after school participation.

5. HEART

5.1 Exercise's Effects on the Heart

Inactivity is one of the major risk factors for heart disease. However, exercise helps improve heart health, and can even reverse some heart disease risk factors.
Like all muscles, the heart becomes stronger as a result of exercise, so it can pump more blood through the body with every beat and continue working at maximum level, if needed, with less strain. The resting heart rate of those who exercise is also slower, because less effort is needed to pump blood.
A person who exercises often and vigorously has the lowest risk for heart disease, but any amount of exercise is beneficial. Studies consistently find that light-to-moderate exercise is even beneficial in people with existing heart disease. Note, however, that anyone with heart disease or cardiac risk factors should seek medical advice before beginning a workout program.



The heart is a large muscular organ chat pumps blood trhoughout the body. Valves inside the heart open and close. This controls how much blood enters or leaves the heart.

6. RISKS

6.1 Alarming Global Trend of Physical Inactivity

World wide, more than 60% of adults do not engage in sufficient levels of physical activity which are beneficial to their health. Physical inactivity is more prevalent among women, older adults, individuals from low socio-economic groups, and the disabled. Physical activity also decreases with age during adolescence, and this decline continues throughout the adult years. In many countries, developed and developing, less than one-third of young people are sufficiently active to benefit their present and future health. Female adolescents are less active than male adolescents. Decreasing physical activity and physical education programmes in schools is an alarming trend worldwide.

At the same time, high body mass Index (obesity/overweight) rates are increasing among young people as well as among middle-aged adults. This is related in part to lack of physical activity in leisure time, but is even more likely the result of people spending increasing amounts of time in sedentary behaviours such as watching television, using computers, and excessive use of "passive" modes of transport (cars, buses and motorcycles). Sedentariness is consuming a great deal of people's time, and the health consequences are significant.

7. ACTIVITIES

7.1 Warm-Up and Cool Down

What is warm up?

A warm-up is usually performed before participating in technical sports or exercising.
A warm-up generally consists of a gradual increase in intensity in physical activity (pulse raiser), a joint mobility exercise, stretching and a sport related activity.

Parts of Warm up:

› THE GENERAL WARM-UP

Joint rotations
(Fingers and knuckles, wrists, elbows, shoulders, neck, trunk/waist, hips, legs, knees, ankles and toes) .
Aerobic activity
(Running, jogging, games, etc)

› WARM-UP STRETCHING

Static stretching:
(Back, sides (external obliques), neck, forearms and wrists, triceps, chest, buttocks, groin (adductors), thighs (quadriceps and abductors), calves, shins, hamstrings and instep) .
Dynamic stretching:
involves a controlled, soft bounce or swinging motion

› THE SPORTS SPECIFIC WARM-UP

The same movements that will be used during the athletic event but at a reduced intensity. Such sport-specific activity is beneficial because it improves coordination, balance, strength, and response time, and may reduce the risk of injury.

Why is important to warm up?

- Prepare the body and mind before exercise.
- Increase the body's muscle temperature to make the muscles loose, supple and pliable.
- Prepare the muscles, tendons and joints for more strenuous activity.
- Reduce the risk of injury.
- Increased speed of contraction and relaxation of warmed muscles.
- Dynamic exercises reduce muscle stiffness.
- Greater economy of movement because of lowered viscous resistance within warmed muscles.
- Facilitated oxygen utilisation.
- Facilitated nerve transmission and muscle metabolism at higher temperatures.
- Increased blood flow through active tissues as local vascular beds dilate, increasing metabolism and muscle temperatures.

What is cool down?

Cool-down is an easy exercise that will allow the body to gradually transition from a post-work-out state to a resting or near-resting state.

Parts of Cool-down:

- Gentle exercise: jogging or walking.
- Stretching: Static stretching and PNF stretching is usually best.
- Re-fuel: Both fluid and food are important.

Why is important to cool down?

- Promote recovery and return the body to a pre exercise, or pre workout level.
- Help with the post exercise muscle soreness that is usually experienced the day after a tough workout.
- Assist your body in its repair process
- Helps all this by keeping the blood circulating
- Prevent blood pooling and also removes waste products from the muscles.
- Aid in the dissipation of waste products - including lactic acid.
- Reduce the potential for Delayed onset muscle soreness (DOMS).
- Reduce the chances of dizziness or fainting caused by the pooling of venous blood at the extremities.
- Reduce the level of adrenaline in the blood.
- Allows the heart rate to return to its resting rate.

7.2 Stand Up Straight!

This unit is composed by diffeent physical avtivities, intelligence games, postural exercises and many “quick pick”, fast and direct activities of 10-15 minutes each, that are collocated under the name “Sessions”.

We decided to create this typology of unit in order to follow the principle aim of the Kit Brain, Heart&Sport focused on the education of the importance of Sport and Physical activity for the development of learning abilities and transferable competencies.

In Fact, through the activities presented in this unit we would like to focus on:

- educational Posture
- coordination and logic-thinking skills
- team Building
- mental approach to life
- sensorial Skills

We have been helped by different training centres across Italy, in order to decide with kind of activities were more suitable for this typology of aims. We collected all the proposals, analyse the target group for this kind of sports and we have adapted it to this type of use.

The activities proposed in this unit is a mix of intelligence games, stretching, mobility and tournament:

- intelligence games: Twister, Game of NASA, Game of “Coweb”, Ball Games, The sense relay race;
- proper posture in the classroom;

- tacfit for the mobility of the body;
- rugby Touch;
- olimpik Park.

Each session has a specific aim expressed inside the unit, correlated the Brain, Heart and Sport kit's aims. The specific aims help teachers determine which activities to use for each group, based on variables such as the availability of time.
The decision on how and when do use all of these activities is up to the teacher, who will analyse the group and the time available. One of the basics principles of this project is flexibility, meaning that all the activities presented can be picked individually or in sequence.

Each of these sessions propose a specific activity or game accompanied by video materials and a pdf, suggestion about the staff involved, duration, safety considerations and warm-up/cool-down phase.

Train for Life

The unit aims to enhance the primary dynamic motor skills by carrying out physical activities related to athletics (running, jumping, somersault, throwing etc.) and free-body workout, with the final goal of developing transversal competences such as: self-control, trust in others and self-esteem, the capability to stay in a group and face the competition, improve concentration etc.
Furthermore, by means of the physical activities, the unit will transfer general educational skills (about human body, senses, feeding, logic etc.) and will strength civic skills and civic education (respect, fair play, civic sense, respect for the environment etc.).
The aim of the activities is to improve:

- physical skills: basic motor schemes (running, jumping, throwing and other activities);
- transversal competences: self-control, trust in others and self-esteem, the capability to stay in a group and face the competition, improve concentration;
- civic skills and active citizenship: respect, fair play, the strengthening of civic values and respect for the natural environment;
- educational skills: strengthen specific educational knowledge, which could vary according to different contexts and the alternative ways used to transfer the knowledge (use of playful and sports component). Among the possible variants, the kit will focus on topics related to proper nutrition, knowledge of the human body muscles etc.).

In order to develop these competences, the following activities will be suggested:

- **relay race:** this educational activity relies on collaboration among players in order to complete the race.
  Development of transversal competences: the relay race develops teamwork capabilities, and thus the trust in others with the aim of reaching a common goal. Players must trust the other team-mates and they also need to take on responsibility.
  As a matter of fact, if the baton is not caught properly by the team-mate, the player should carry out a specific exercise (for instance squat) as a penalty.
- **obstacle course:** this activity has been suggested because it can develop physical, cognitive and sensorial skills. Indeed, this activity is the perfect combination of speed, dexterity and concentration.
  Development of transversal competences: the individual becomes more autonomous and can increase awareness about his/her abilities and limits, develop problem-solving skills and concentration skills. During this activity, as well as during the relay race, the teacher will address a quiz and questions to the participants/students. In case of a wrong answer, the participant will carry out specific exercises.

- **the Vortex:** the vortex is an equipment made of sponge and plastic whose weight is 150 grams. It is used in the athletics and is propaedeutic to the javelin or the shot put.
  The vortex enhances the strength of the upper limbs, thus enhancing the muscle strength.

Development of transversal competences:
Individual exercises: the individual is alone while practicing the exercise with the vortex. Therefore, this activity can increase the self-esteem of the individual and can help her/him to focus on the goal of a competition.
Team activities (throw, relay race, rugby 5x5):

- **physical:** enhancement of conditional and coordinative skills
- **behaviour:** Awareness of the body as a means of self-expressiveness
- **physical:** enhancement of conditional and coordinative skills

7.3 Swimming for life

In this unit can be found three types of activities, educational activities, enabling us to better understand how the body reacts to a physical workout and also allow us to acquire knowledge on how we can improve our aerobically stamina skills independently.

The second type of activities are practical activities to improve physical capacity either through games or activities based on a specific training.

Finally, there are activities related to swimming. Why swimming?
First of all, the main objective of the Kit Heart, Brain and Sport is to improve both the physical and mental state and in this sense is one of the few sports, if not the only one that works holistically all body at a time, also improves the physical condition in terms of stamina also improves posture issues such as back pain and improves lung capacity.

In additional to the physical benefits, we wish that swimming will teach a student to learn how to manage their own training, and gain a knowledge of the type of training most appropriate for improving their technical ability, stamina and health.
We also wish to work on a cognitive level, allowing students to both practice and become part of the process of improvement, leading to the active pursuit of further training.
One of the specific objects is aerobic work, which is good for the circulatory system. Practicing this kind of work from an early age improves and prevents respiratory diseases such as asthma and bronchitis.
The health benefits of sport are well-known. It makes positive physical and mental changes, and helps to cultivate a healthy lifestyle. Many studies confirm this idea, such as the 2012 New York Times piece “How Exercise Could Lead to a Better Brain” (www.nytimes.com/2012/04/22/magazine/how-exercise-could-lead-to-a-better-brain.html). This kit includes activities designed to enhance mental, affective and social skills.
This study will try to demonstrate that both physical and mental capacities can improve with an appropriate kind of exercise free of injuries and stress.
Therefore, will give some guidelines to raise awareness about what kind of exercise and what methodology best improves physical and mental health.
In this kit we are going to develop two kind of activities, on dry land and in water. On dry land sessions we will try to improve stamina using a methodology based on aerobic workout and leisure exercises, and in water sessions we will try to improve different kinds of swimming techniques.
The aim of this Unit is to give students some guidelines to let them how to get better their life through the exercise and see what mental changes they have noticed and experienced.

8. LEGENDA

8.1 Introduction

Inside each kit you will see different colours for each session. All three kits share a common legend.
Below you can find the specific divisions created for the Brain, Heart and Sport kit, which indicate how approachable each session is to students

8.2 Explanation of the different colors

RED

The high level of difficulty is represented mainly by the need to have competent personnel in the field of physical and sports activities.
The proposed activities do not have inherently high learning difficulties, with the exception of swimming where knowledge of the specific styles of the discipline and therefore each student is required must have required motor skills suited to the task.
With swimming, you must also take account of the educational component, including physicality and socialisation in a pool environment.

YELLOW

The average level is represented by both the difficulty of the exercises run by both the need to have trained staff on average (knowledge of the physiology of the movement).

GREEN

The simplest level is the one that offers a low degree of difficulty in performing exercises and activities can also be carried out by unskilled people.

8.3 Approachability of the developed units

Unit 1
STAND UP STRAIGHT

The games vary in difficulty from simple to complex, but does not provide for a particular technical expertise on the part of the instructors.
Some very simple sessions may be used in different ways depending on the time of year and the level of attention of the Group, being easy to perform.

Unit 2

SWIMMING FOR LIFE

Gradually increasing the difficulty is represented by the knowledge of the different swimming techniques and training methodology that provides different skills:

- knowledge of the techniques of the different styles from the boys;
- technical and methodological skills instructor;
- knowledge of sports training methodology and stamina methodology.

Unit 3

PREPARING THE FIRST LESSONS OF SWIMMING

It is important to learn a few basic swimming techniques so you can feel safe in the water, This unit represent the basic knowledges of swimming. All the sessions are studied for basic style of swimming and basic steps in order to be confident in the water.

Unit 4

TRAIN FOR LIFE

The activities are simple to implement and can be realized with ease by all groups.
In order to further involve young people, the teacher should be able to organize the activity without pauses so you may want to have a sufficient number of sports equipment.

Unit 5

WATER AEROBICS

Water aerobics (waterobics, aquatic fitness, aquafitness, aquafit) is the performance of aerobic exercise in fairly shallow water such as in a swimming pool. Done mostly vertically and without swimming typically in waist deep or deeper water, it is a type of resistance training. The classes focus on aerobic endurance, resistance training, and creating an enjoyable atmosphere with music.

Unit 6

QUICK PICK - STAND UP STRAIGHT

The activities are simple to implement from a technical point of view. The teacher's skills will be to engage and motivate students with both proposals involving the use of music and is extolling the benefits of postural it has preventive purposes: preservation and improvement of one's body.

Unit 6

QUICK PICK - WATER AEROBICS

Really basic and fast sessions of basic water aerobics activities that enable you to understand the techniques necessary to do aerobics into water.

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