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Experiences & Perspectives

The influence of the natural environment on learning in primary school students

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Abstract

contact with nature changes us in many ways: after a walk in the forest, our body, brain and feelings are different. Those changes have an explanation: green places provide us with numerous benefits. This scientific review explores the relationship between nature and primary education, and the results can make a difference in the way we teach and how we can rethink the education locations. For that, literature on research from the last years in the topic is reviewed to show the scientific evidence of nature effects in students.

First, a comparison between rural and urban areas as a place of living and studying and the decreasing numbers of people living in the countryside is presented, compared to the increasing amount of the population moving into the urban areas. A second section shows how nature can stimulate the brain in a way that provides benefits for academic tasks and also helping students having better behaviour and health. Furthermore, the article reports which kind of places provides a better learning development related to green spaces.

Decreasing levels of cortisol, higher levels of concentration, motivation or more participation of the students, are some of the outcomes that nature can bring as a learning space. Though, not only benefits exist for education, but also health takes part when it comes with nature: fewer levels of depression or anxiety are also found in people living surrounded by nature. Focusing on building and reconstructing schools providing more green spaces and large windows to observe wildlife can be helpful in a city area. Use the forest or the playground as a place of learning can be another easy and effective way of taking all the benefits that nature can provide to our students in rural areas.

Keywords: nature, brain, green spaces, primary education, educational environments, attention, restoration.

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Resum

El contacte amb la natura ens canvia de moltes maneres: després d'un passeig pel bosc, el nostre cos, el cervell i els sentiments són diferents. Aquests canvis tenen una explicació: els llocs verds ens proporcionen nombrosos avantatges. Aquesta revisió científica explora la relació entre la natura i l'educació primària, i els resultats poden marcar la diferència en la manera com ensenyem i en com podem replantejar-nos els espais educatius. Per a això, es revisa la literatura sobre investigacions dels darrers anys relacionades amb el tema per mostrar l'evidència científica dels efectes de la natura en els estudiants.

En primer lloc, es presenta una comparació entre les zones rurals i les zones urbanes com a lloc de vida i d'estudi i la disminució del nombre de persones que viuen al camp, en comparació amb la quantitat creixent de població que s'instal·la a les zones urbanes. Una segona secció mostra com la natura pot estimular el cervell d'una manera que proporciona beneficis per a tasques acadèmiques i també ajuda els estudiants a tenir un millor comportament i salut. A més, l'article informa sobre quin tipus de llocs proporciona un millor desenvolupament d'aprenentatge relacionat amb els espais verds.

La disminució dels nivells de cortisol, els nivells més alts de concentració, la motivació o la participació dels estudiants són alguns dels resultats que la natura pot aportar com a espai d'aprenentatge. Tot i que no només existeixen beneficis per a l'educació, sinó que també hi participa la salut quan es tracta de la natura: també es troben menys nivells de depressió o ansietat en les persones que viuen envoltades de natura. Centrar-se en la construcció i reconstrucció d'escoles que proporcionin més espais verds i grans finestrals per observar la vida salvatge pot ser útil en una zona de la ciutat. Utilitzar el bosc o el pati com a lloc d'aprenentatge pot ser una altra manera fàcil i eficaç d'aprofitar tots els beneficis que la natura pot proporcionar als nostres estudiants a les zones rurals.

Paraules clau: natura, cervell, espais verds, educació primària, entorns educatius, restauració de l'atenció.

Introduction

Despite being aware of the relationship between contact with nature and numerous health benefits, as well as the shortcomings of lack of it, children now spend less time in nature and more in urban environments[1].This article aims to address a careful review of the studies and research done to date on the impact of the natural environment on primary school students. Also, and according to the research carried out through the review of several published studies, some are proposed to obtain the benefits which bring contact with nature can bring to the learning process. These indications show bringing the natural environment closer to the classrooms of primary schools in urban areas that do not have a natural setting in their immediate environment as a starting point.

From a neurobiological point of view, Payam D.[2] shows how being surrounded by a prolonged natural environment causes structural changes in the right prefrontal cortex and right premotor cortex, such as the increased volume of the grey substance and increased white matter in both hemispheres of the brain[2]. It is related to improved working memory and a decrease in lack of attention, consequently, it benefits learning. The author also participates in the Brain Air School Investigation (BREATHE) project, which studies Barcelona's pollution levels. In one of his researches in Alemany, et. al. compare schools with and without a green environment[3]. The results

show how students between 7 and 10 years of school exposed to green space show these positive structural modifications in the brain. This study is part of the Institute of Global Health (ISGlobal), where its director, J. Sunyer, also talks about brain development in school ages. In one of his studies he depicts how schools are affected by pollution (applying to those areas located in high levels of traffic and mostly urban environments) and observes how the development of those children's brains occur slower in polluted environments causing them lessening their cognitive abilities such as attention and working memory[4].

Dr. M. Kuo analyzed the effects of direct contact with nature have on health, and provided evidence on the relationship between worldwide and the brain in learning[5]. The study shows that the deficit of nature in children can cause higher levels of stress and anxiety. These factors are related to an increase in the hormone cortisol and, at the same time, a higher rate of obesity and attention deficit. On the other hand, the group of students who have had contact with nature show lower blood cortisol levels and have a higher level of self-control. Also, being surrounded by nature facilitates sports practice, which helps to improve efficiency in cognitive processes[5]. In other words, nature promotes movement and cardiorespiratory exercise, which consequently increases academic performance.

Revision Sections

This section analyses the influence of the natural environment on the learning of primary school pupils, reviewing studies that show the differences between rural and urban learning environments. There is also an exploration of the changes produced in the brain as a result of being in contact with nature, looking for what characteristics the 'nature' should have so that the brain modifications have more incidence. Additionally, the value that the environment can create in the educational field is analyzed to reduce the 'deficit of nature'.

Benefits of rural vs urban areas

Currently, there is more population living in urban than rural areas, that is, society is increasingly out of touch with nature[6]. This fact has its beginnings in the Industrial Revolution, where the population migrated from the fields to the city. In this change, families and their sons and daughters also entered, gradually losing contact with nature and getting closer to urban areas. Due to the urbanization of cities, which involves the loss of spaces and a green environment, the progressive decrease in children's interaction with nature became even more evident. At the same time, the increase in the 'culture of fear' in the last decade, about the outdoors as a risk space for children, and therefore, as an unsafe leisure area, has also reduced this levels[6]. Population migration to urban areas means that learning centers, such as schools, have less contact with green spaces.

Capaldi Colin et al.[7] from the University of Ottawa, Canada, show how the binomial 'nature-learning' has beneficial causes and effects. Improved attention and decreased stress levels are some of the parameters that have been checked. Additionally, the regulation of impulse, self-control, motivation, and student participation, also improve during and after children's exposure to nature. These results are complemented by research carried out by ISGlobal related to the increase in white matter in cerebellum hemispheres and improved working memory.

Nature and brain

Beyond the evidence shown above, modifications have also been identified in the functioning of the brain. These, show the incidence that nature has in our brain health.

Kuo M. says the following in one of his studies where he relates health to nature:

> *Blood tests before and after walks in different environments reveal that levels of health protection factors increase after the forest walk, but not urban.*[8](p.2)

In the same article, Kuo states that the amount of 'green', referring to the nature that surrounds an environment, determines the levels of mortality risk. Therefore, the less risky nature, and vice-versa. It also refers to pathologies and/or diseases that affect health and states that contact with nature can help prevent and improve them. Some of these have a close relationship with disorders found in primary school classrooms, such as attention-deficit/hyperactivity disorder (ADHD), depression and anxiety disorders, obesity, and migraines[8].

Linked to the brain transformations that the relationship with the natural environment brings, it is worth to mention the restoration of attention, a concept discovered by Kaplan[9], who was one of the pioneers in the research between nature and the benefits derived from the relationship with it. His theory of ART restoration (attention restoration theory) explains that mental fatigue and concentration can be improved if you spend time observing or being in nature. It also reduces stress levels and facilitates the ability to focus on targeted care and cognitive control.

One the mediating hormones of 'stress' is cortisol. Literature extensively shows that the more quantity of cortisol, the more levels of stress, and vice versa[9]. Checking the level variations of this hormone before and after a walk in the forest can determine the positive effects derived from this practice. But for this reason, it would be necessary to compare it with a walk through an urban environment and thus determine whether the effect of the decrease of cortisol is caused by physical activity (which in case it decreases the levels of this hormone) or by being surrounded by a natural space. Antonelli et al. respond to this dichotomy, which was from a group of subjects, who suffered from diseases such as depression, anxiety, or attention deficit, he used salivation and blood cortisol levels as a biomarker of stress. Using the study on a Japanese practice called "Shinrin-yoku", which consists of walking through a forest environment, observing it, and breathing its air, it shows the positive effects that walks have on forest environments over the urban ones[10].

Types of green spaces

Not all natural spaces affect in the same way, as Szolosi et al.[11] Shows in his study how spaces that generate more ''mystery'' create a greater impact on the brain developing attention capabilities.

Related to the typology of nature, Donnell, A. and Rinkoff R. make a comparison on nature and childhood between two countries, Canada and Slovakia, and draws these conclusions:

> *The theory and analysis of grounded content reveal that culture plays a role in the connections of young children with nature. Children from both countries showed positive feelings towards nature, but the way they were related was culturally different.*[12](p.83).

For example, a group of preschoolers in a territory can perceive nature as animals and plants, while in another place students can relate it to other elements such as water and stones. These changes are due to the culture of the country, but above all in the pedagogy that students receive related to their environment.

Green educational environments

Linked to the previous section, it should be noted the capacity of humans to adapt environments so that they are "neuroeducationally" healthy, thus creating learning spaces according to the knowledge of the research that has been done. One of the factors to take into account are the green spaces found in schools, and the windows to be able to contemplate them. For example, Li D. Sullivan showed in a study in high school students that visions of green landscapes in school help students recover from mental fatigue and stress. Architects such as R. Bosch and J. Ishigami presented projects of educational centres where open space and the opportunity to contemplate nature takes strength[13].

However, architects are not the only professionals that showed interest in student learning. Geographers Hickman Dunne and Mills[14] talk about outdoor space as a place of training and information based on their research. They propose natural spaces to carry out training (academic) and leisure activities (recreation and play).

Related to outdoor learning, and linked to the interest in knowing better what the effects of nature are on learning, a recently published study by Otte et al. and conducted in Denmark for a whole year, showed that learning reading outdoors for a minimum of two hours a week provides a significant improvement in the reading field of primary school students[15].

The Nordic countries have for sure that nature-learning binomial brings benefits for students and Sweden has also opted for an outdoor education16, in this case using the forest garden as a pedagogical space. The results show that this interaction with this green space, as well as with the organisms that live there, entails a greater capacity for concentration and tranquillity.

Indications and proposals for a greener environment

Some schools do not have a forest or green land near their area to benefit from contact with nature. However, the investment in trees, green areas, and windows that allow the visibility of these spaces can significantly help to improve the conditions of the school and, consequently, its students.

The proposal for improvement lies in encouraging investment in green space for schools that do not currently have access to them and enhancing the use of those that already have a green environment nearby. The regulation of school outings in forests and urban gardens can be a facilitating tool, always accompanied by pedagogical proposals that help teachers to rely more on the natural environment as a space for learning and brain transformation.

Conclusions

The decrease in children's contact with nature in schools is a factor evident in recent years due to the mobilization of the rural population towards urban areas. This has not only affected the population and their homes, but many schools have been located far from a green environment.

Research by leaders in the field, such as M. Kuo, shows that nature is necessary for good regulation of some hormones such as cortisol, which promote learning because they improve health in the cerebral and body spheres. In addition to the benefits mentioned above, the reduction of disorders such as attention deficit and/or hyperactivity in students has also been proven. The new-look towards green spaces is no longer a merely aesthetic issue, it goes further, and it is considered mental health.

Currently, some Nordic countries, such as Dinamarca[15] or Suècia[16], pbecome aware and implement studies that show evidence of improvement in student learning and behavior when internships are carried out in green spaces. This highlights the need to remember the importance of green environments in the educational stage, especially in earlier education.

One difficulty in doing this review has been to find research that is accurate and specific. A large part of this scientific review is constructed from research carried out in groups with a great diversity of ages, therefore, with little specificity towards the primary stage. Further, the dissemination of theories that relate nature and learning without a scientific foundation is widespread in non-scientific journals. In general, you can find a wide range of interesting articles that talk about educational practice in nature, but to include them in this scientific review, it would be necessary to pass them through the sedation of the scientific method.

Finally, no study has been found to contradict the health benefits that contact with nature brings.

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