“The Educational Workplace”

What the “classroom of the future” will look like

Dr Dieter Breithecker

Haltungs- und Bewegungsförderung

Posture and Mobilization Support

A four-year pilot study on a “movement-ergonomic” workplace design and “movement-oriented” teaching methods for primary school students

Synopsis

Bundesarbeitsgemeinschaft für Haltungs- und Bewegungsförderung e. V.

[Federal Working Group for Posture and Mobilization Support]

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“The Educational Workplace” -
What the “classroom of the future” will look like

Introduction

Currently, health promotion in schools is growing ever more important. A school preparing students for their future can only be a school at which basic health promoting conditions take its students’ well-being into account..
In this context, the students’ “workplace” has to receive much more attention in terms of a better inclusion of ergonomic seating and working conditions which has been the center of public debate. Not only do adults spend an increasing amount of their time sitting, but students as well.

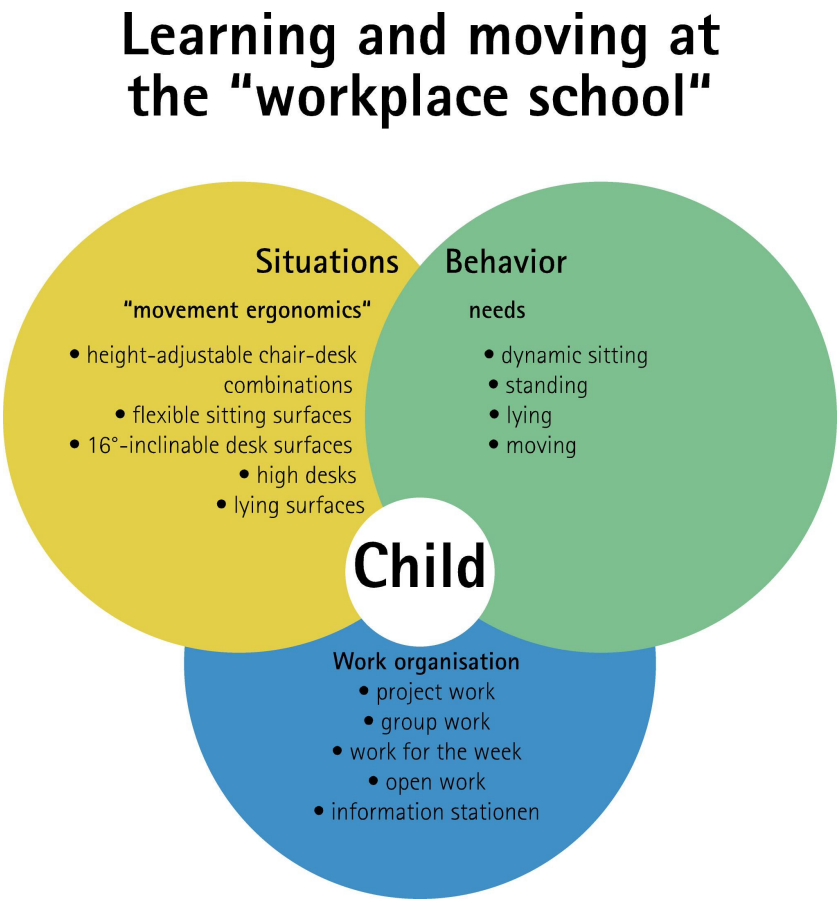
The Project’s Concept

Health, Well-Being, Attention and Concentration –
Ergonomic Conditions and Mobilizing Teaching Concepts Are Decisive.

Preceding the four-year pilot study (2000-2004), a cooperation of experts yielded specific ideas on the design of a “workplace school”, incorporating both “movement-ergonomic“ features - adjusted to students’ height – and ergonomics demanding an active and dynamic physical behavior. These are based upon the pillars of situational prevention and behavior prevention fully acknowledged for workplace safety practices and deemed essential for health and well-being. These have here been adjusted to school requirements.

Adolescents’ behavioral needs on the one hand and workplace solutions (situations) compatible with a growing organism’s basic conditions in terms of its maturing and development and movement-oriented teaching methods on the other have been included in this study as indispensable, mutually activating methods of intervention (cf. figure 1).

Figure 1: **The child is at the forefront**



Objective

It was the study's objective to see in how far situational and behavior-specific interventions might have an impact on students:

- physical and working behavior
- physical motor development processes
- medical-orthopaedic development processes
- attentiveness and concentration capability

within the four-year study period.

Study Design

The study comprises the four-year primary school time span. The test group was made up of four classes of the Fridtjof-Nansen-School in Hannover, Germany. This school, with 400 students from 21 countries, is located in one of the city's so-called

“deprived areas”. Over the four-year study period, the test pupils were encouraged to indulge in motile physical behaviour by the “movement-ergonomic” and work-organization-related interventions shown in figure 1, with their teachers having been extensively trained for that purpose.

The control group consisted of a neighbouring primary school having similar socio-economic attributes. This school featured conventional school furniture and its teachers had received no training in behavior-preventive measures.
All in all, 89 students available for the entire study period were included in the evaluation, 62 from the test classes and 27 from the control classes.

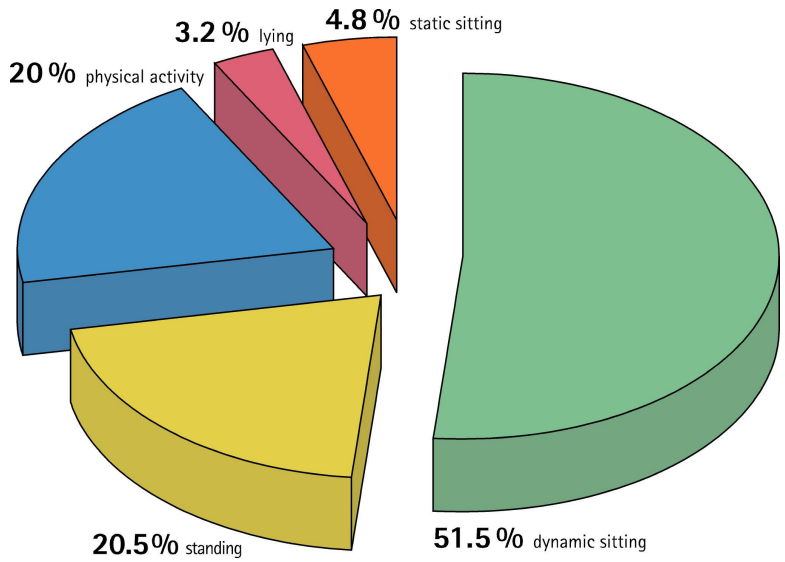
Study Methods

To prove our hypothesis – a positive effect of the aforementioned intervention measures – we had compiled an extensive range of test methods, i.e. monitoring of ***behavior*** (physical and working behaviour), a ***physical motor*** (diagnosis: strength, coordination, agility), and ***medical-orthopaedic*** (posture analysis) study design and an ***attentiveness endurance test***.

Findings

At the conclusion of the four-year pilot story we found, in agreement with our hypothesis, that on the basis of situational and behavior-specific interventions, the test group’s ***physical and working behavior*** was much more dynamic than the control group’s (cf. figure 2).
While it is obvious that a sitting position was predominant in both groups, it was found that in the control group this was static but in the test group rather active-dynamic. Here we find what we rendered a basic requirement of “movement-ergonomic” principles: “*Classroom furniture has to be able to adapt to its user’s healthy need of movement!“*
The high desk used in the test classes and the movement-oriented teaching methods and forms of organization were also decisive for our test pupils being able to show a lively, active-dynamic physical and working behavior (cf. figure 2).

Figure 2: **Physical behavior in the test group (over the four-year study period)**



Definitions

Static sitting: The child does not change its sitting position within a 1-minute monitoring period.

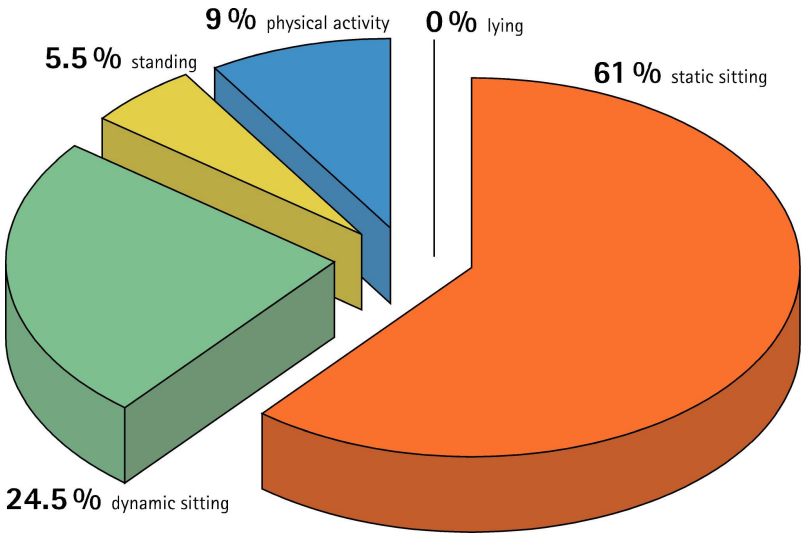
Active-dynamic sitting: The child irregularly changes its sitting position, incl. bopping up and down or fidgeting.

***Standing*:** The behavior used by a child to work in a standing position at a suitable place (high desk) in the classroom.

Physical activity: The child moves around in the classroom as defined by its task.

Lying: The child lies on the floor to do his or her work.

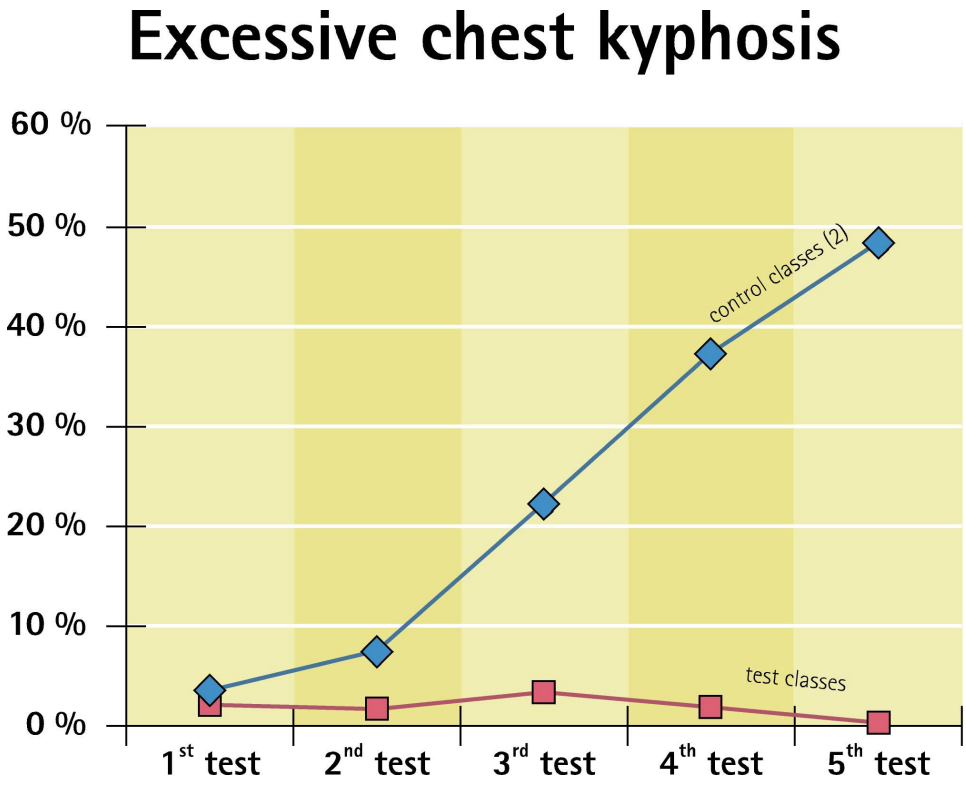
Figure 3: **Physical behavior of the control group (over the four year study period)**



This reduced a static-passive and thus a potentially posture-damaging behavior among the test group through frequent changes in posture.
In addition, these lively changes in posture, in combination with the movement-oriented teaching methods and forms of organization, had a positive influence on the highly sensitive and maturing motor processes at this age. which was also found in the medical-orthopaedic and physical motor evaluation.

At the end of the study, all test variables used or the ***medical-orthopaedic study*** revealed a diagnosis among the pupils of the control group worse than among those of the test group.

Figure 4: **Pathogenesis of chest kyphosis in the category "excessive chest kyphosis"**



A significant deterioration has been seen in the physiological curvature of the spine – chest kyphosis and lumbar lordosis, as is exemplified by a comparison of the

pathogenesis of chest kyphosis between the groups within the four-year study period (cf. figure 4).

This leads to the conclusion which has been assumed by many international experts and in part has been scientifically verified: Sitting in a static/passive educational environment impedes a student's postural development in their adolescent development years (cf. Amstad, H. et al. 1992; Gunzburg, R. et al. 1999; Troussier et al. 1999). Traditionally designed school furniture with a rigid reclining sitting surface is particularly responsible for a curved back posture permanently exposing the postural system to nonphysiological strain (cf. Senn in Illi 1991).

However, it is not only the passive postural system which is adversely affected, but also the active postural and movement system which shows a nonphysiological course as the ***physical motor activity study*** has confirmed.
While no statistically relevant differences in strength, coordination and agility between the two groups were found at the study's commencement, at their concluding level – with the exception of one variable – all variables show significant differences in their mean values in favor of the test students.

Figure 5: **Furniture and teaching methods which allow movement encourage a motile physical behavior**

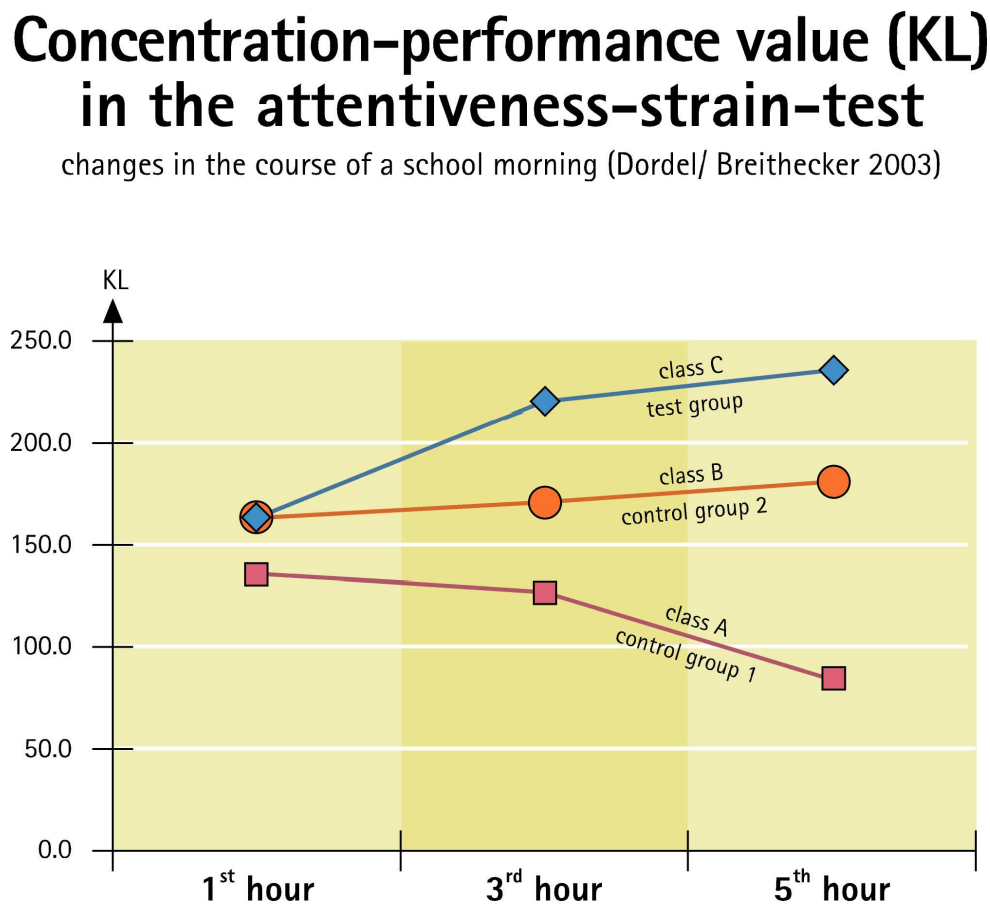
While all improvements of strength endurance shown to be significant can primarily be put down to coordinative and/or neuromuscular improvements, this supports our assumption that active-dynamic physical behavior had a positive effect on the vestibular-kinaesthetic system. This triggered control processes that are of vital importance to postural development and awareness and also to physical coordination and awareness.
Postural control requires a good self-perception (Bader-Johansson 2000). This only confirms the theory that in the highly sensitive primary school age the differentiating neuromuscular systems are particularly dependent upon regular motor stimulation.

Furthermore, the kinaesthetic-vestibular stimulation effects a reflexive activation of the limbic system, responsible for the waking state and thus for attentiveness and concentration, which was also confirmed by our ***attentiveness endurance test*** (Test „d2“, Brickenkamp 2002).

Again, we were able to prove considerable increases in the test group's (C) concentration performance at almost all times we measured it and when compared with the control group (A) and an additionally included group (B) able to take a 25-minute mobility break three times during the school day. The only negligible improvement in the concentration performance value (KL) was shown in the third and fifth lesson (see figure 6).

Many recent studies leave no doubt that there are connections between motor activity and cognition, an impact on learning by perception and movement and on children's learning and performance (Spitzer 2002, Hollmann et al. 2005).

Figure 6: **Concentration performance value (KL) in the attentiveness endurance test (Test d2) – changes in the course of one school day (Dordel/Breithecker 2003).**



Summary/Outlook

Learning at school is still deemed a one-sided cognitive, merely cerebral process and this is to be balanced by a sensorial-musical-creative kind of learning. The various aspects (cf. figure 1) of the intervention measures used in our pilot study have contributed to a rhythmic school life and the related physical, mental and emotional development processes considerably. This made for a reduction of common stress factors and much momentum for the highly sensitive maturation and development processes of the age group in question.

This revealed significant findings for a “school of the future” which should provide basic conditions for a healthy physical and mental/emotional development of children.

Lessons which are supposed to meet children's psychological motor needs can, in the final analysis, only be achieved if there is a "workplace" which avoids one-sided physical and psychological-cognitive stress through a correlative organization of lessons and work and situations and behavior. We should thus try to create basic conditions which allow or encourage a continual switch from stress to relief, immobility to mobility, and tensing and relaxing the bodily structures involved in the sitting position.

Whoever wants to promote following generations' health has to start now. The demand for "movement-ergonomic" school furniture, a mobile sitting and physical behavior, must be now to show an immediate effect.
In order to maintain health and well-being even in a rather sedentary world of work one has to start providing information, a practical application but also the use of the best possible school furniture in early childhood.

On the basis of this study's findings it is thus unthinkable to buy rigid school furniture incompatible with children's need of movement, especially as such purchases would delay new developments in that area for at least another twenty to thirty years.
Huge deficits notwithstanding, the huge significance obviously attached to the "movement ergonomics" of students' workplaces and to getting used to the corresponding dynamic sitting behavior should lead to a review and optimization of the equipment in classrooms with a view to an efficient health promotion and a support of students' performance.

The author of this report would be glad to furnish you with further information and bibliographical references.

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