



# Bodies in Motion - Brains in Motion.



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# Get out of the sitting trap!

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Scientific documentation on the effects of dynamic sitting can be found on:  
<http://www.haltungsbewegung.de/ergonomics-for-children.aspx>



Illus. 2: Rigid Seating

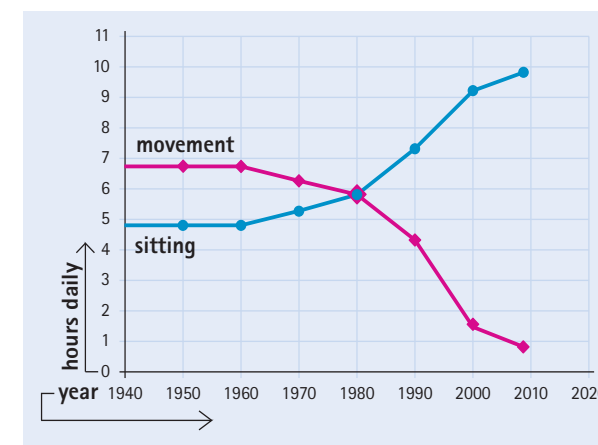
**Successful learning must engage the body, the mind, and the soul.**

One reason that traditional teaching involves students sitting rigidly in their assigned seat is that many people still believe the brain is somehow separate from the body and that the body is not used when we learn.

Constantly telling students to sit still or to sit up straight reinforces the unfortunate disapproval that some teachers have traditionally shown towards the natural movement needs of children. Combined with the static design of most academic furniture, students are deprived of critical physical and sensory experiences that are essential for physical and mental growth.

Developing children have become accustomed to passive-receptive physical behaviors and quickly fall into a trap of inactive sitting. (Illus. 1) Through this, physical development can become unbalanced.

Inactive sitting places greater stress on the tissues and systems of developing bodies. Students forced to remain still in a physically static environment become more uncomfortable, more tired, and less productive. In fact, the number of students who develop sitting-related musculoskeletal symptoms and disorders continues to increase.



Illus. 1: This graph shows the trend (average time per day) of less movement (pink) and more sitting (blue) among adolescents since 1950.

# Proper chair/desk adjustment? This is how it works:

## First, how does the chair fit?

Measurements have shown that students with the same body height can have a range of lower-leg lengths. One standard size seat and desk does not provide an ideal fit for a wide range of students.

Therefore, it is important that the optimum seat height for students is based on the actual measurements of lower leg length.

The chair height should be selected so that the front edge of the seat is in line with the bottom of the student's kneecap. (Illus. 3)

The angle between the upper legs and the trunk should be slightly greater than 90°, so that the hip joint is above the knee joint.

Both feet should have full contact with the floor. There should be approximately three to four finger's space between the front of the chair and the back of the knees at all times so that even when leaning all the way back, the lower legs never touch the front of the chair.

The back of the chair should be contoured so that it is supporting the students' spine, especially while leaning back. The height of the back rest should reach at least as high as the shoulder blades.



Illus. 3: Chair Adjustment

## Second, adjust the height of the desk.

In a forward-facing, upright sitting position, relax the arms against the sides of the body. Now angle the arms at 90° while resting the fingers on the surface of the desk. (Illus. 4) The desk surface should meet the fingertips at the height of the 90° angle.

### Recommendation:

Adjustable furniture is the only way in making sure all students have chairs and tables that are exactly the right size. While most ergonomic learning environments should provide adjustable furniture for all students, unfortunately, this approach is not always financially feasible.

As an alternative, providing adjustable furniture for approximately one-third of each classroom will literally solve most adjustment issues. In addition, choose the appropriate chair and desk height according to the recommendations of the new international size standards (EN 1729-1) and the VS color dot system. However, in special environments and high use spaces, like computer rooms, teachers and students need furniture that can be adjusted easily and quickly. Adjustable furniture provides the flexibility required of spaces that serve multiple age groups throughout a school day.



Illus. 4: Desk Adjustment

## The Alternative: Fixed height furniture in 6 different sizes!

### Chair/Desk sizes according to CEN prEN 1729-1.

Correct sitting and ergonomic working environment can only be achieved when the student's chair is regularly adapted to suit the user's height. If height-adjustable furniture cannot be made available to all students, then it is important to follow the CEN prEN 1729-1 recommendations. According to this standard, six chair and desk sizes have been determined depending on body height and seat/desk height correlations.

The decisive factor is the regular checking of the student's size and individual furniture selection, because the height of students in one class level depends on their individual development and can vary considerably. In other words, each student needs a chair and table which suits his or her height. All students are growing, but there can be significant differences from one student to the next in terms of height and other physical proportions.

Children often sit at furniture combinations that are not suited for them. However, without correctly sized furniture, students could suffer from postural damage as well as head and back pain. The six chair sizes can be easily recognized by their colored stickers on the back of the seat shell. Chairs range from a seat height of 12.2" in size 2 up to a seat height of 20.08" in size 7. The corresponding table heights range from 20.87" to 32.28". Thanks to the many size options, students of all heights can find optimal sitting and learning conditions.

## PantoSwing: Dynamic sitting in schools.

In the case of the PantoSwing cantilever chair, a change of position of the center of gravity changes the inclination of the seat. In the forward sitting position, the seat also inclines forwards, which stimulates the spine to a dynamic balance and stabilizes the posture.

The dynamic seat of the PantoSwing encourages the ergonomically important regular alternation of various sitting positions. Such dynamic sitting with movement has a positive effect on various groups of muscles, activates both body and mind, and has been shown to increase the attention and ability of the children to concentrate.

The decisive factor to achieve the ergonomic effect of the PantoSwing is the correctly chosen chair size. Ideally, the front edge of the seat should be approximately the same height as the bottom of the kneecap. As mentioned before, the PantoSwing is available in 6 sizes to suit individual children.



Illus. 5: Students differ in height and proportion. Therefore, using correctly sized furniture is important!  
Seat shell sizes (w, d): XS (12-5/8", 11"); M (14-5/8", 14 1/4"); L (17", 16-1/2"); XL (17 7/8", 17-3/4")

# Learning from children is learning from nature.

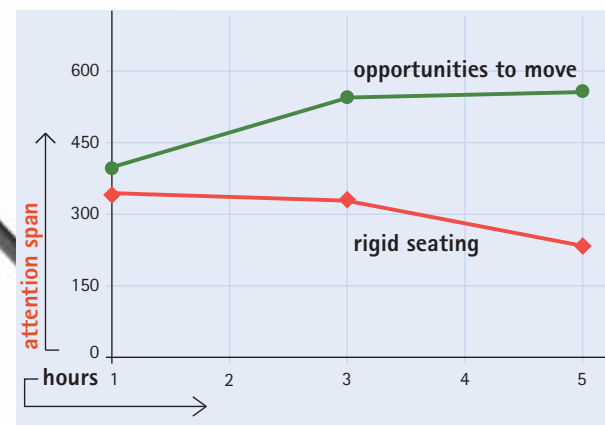


**Illus. 6:** There is a strong relationship between brain activity and kinesthetic stimulation (the perception and movement of one's body).

The human body is not designed to be static. Numerous scientific studies have shown important interconnections between body, mind and soul. Human development is dependent upon movement.

*"Watching a child makes it obvious that development of the mind comes through movement"*  
(Maria Montessori)

Physical movement increases oxygen supply and is essential for stimulating cognition. When students are physically engaged, specific hormones are released that have a positive influence on brain activity. As a result, attention spans grow longer, and the ability to concentrate improves. Research proves that this relationship between movement and brain activity leads to better academic results (Illus. 7).



**Illus. 7:** Research has shown that giving students increased opportunities to move while seated (i.e., rocking or swiveling) triggers increased levels of attention and concentration during test taking (green). The control group, which remained in a rigid seating position, is shown in red.

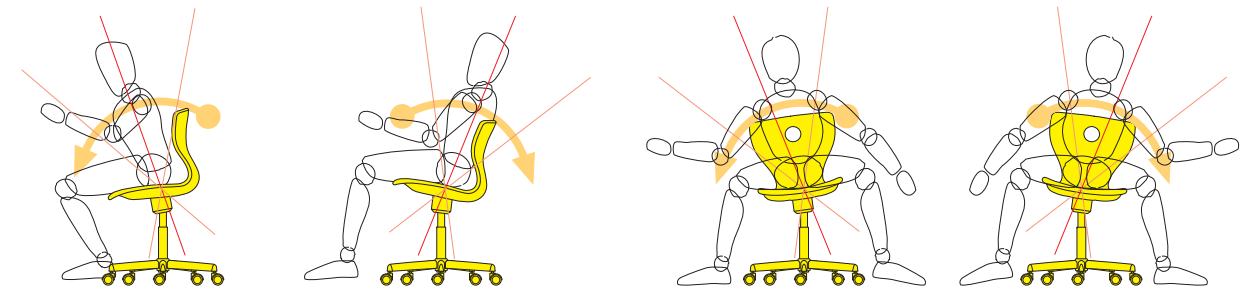
# Make peace with fidgeting!

Therefore research showing interconnection between moving and brain activity invalidates the commonly held notion that moving is somehow counterproductive to paying attention.

A student leaning back, fidgeting or tilting her/his chair is generally exhibiting **healthy active behavior - not hyperactivity**. This behavior is the body's way of supporting the brain. For students to be appropriately engaged, both physical and mental states need to be focused on working together. Once this goal is accomplished, the challenge then becomes how to design classroom furniture - and classroom activities - that meet the physical and mental needs of the developing human body and mind.



**Illus. 8:** Fidgeting is important **but dangerous** on a rigid/traditional chair.



**Illus. 9:** 3-D Rocking mechanism

# Fidgeting boosts the brain.

Because the **natural behavior of children is fundamental** in the design and function of classroom chairs, students need furniture that can help them twist, rock back and forth, and swivel around. Resulting from normal subconscious activities, fidgeting is a natural strategy the brain relies on to insure the physical and mental survival during periods of sustained concentration and immobility. Therefore by allowing small movements during class, teachers and ergonomic furniture can increase a student's ability to concentrate and develop normally.

Unfortunately, our society is used to the constraints of traditional furniture, so it will take time for people to begin thinking outside the box.

The design of the human working space is based on the knowledge that the body, and particularly the growing body, is not made to sit still for long periods of time.

#### Students aged...

6-10 can't sit still more than 5 minutes on average.

11-15 can't sit still more than 15 minutes on average.

15-20 can't sit still more than 25 minutes on average.

Because a sitting student is in a constant physical relationship with one's chair, school chairs need to be able to accommodate a range of natural movements – not hinder them. This need can be met by an ergonomic roll-swivel chair with the seat surface that offers three dimensional movements.

The seat adjusts to all subconscious position changes of the student's body and simultaneously encourages the body to change itself. This active seating has a natural rhythmic effect on the entire postural system.



# Think outside the box.

#### Active seating has the following benefits:

- Spinal positions are regularly shifted
- Intervertebral disks are continuously flooded with nutrients
- Complex back muscles are stimulated
- Over 100 joints in the spine are constantly in movement
- Internal organs operate more effectively
- Blood circulation and oxygen absorption are optimized
- Neurochemical processes, including those that promote concentration and attention, are enhanced

Illus. 10: Active sitting helps students sit longer.

# Promote good posture!

Dont's



Illus. 11



Illus. 12



Illus. 13



Illus. 15



Illus. 16

A student's weight naturally shifts forward during activities while working at a desk.

Disadvantage of a fixed chair seat:

Illus.11: The undersides of the upper legs are cut off, which restricts blood flow.

Illus. 12: The back is hunched over, which results in bad posture and restricts the movement and function of internal organs.

Illus. 13: In order to alleviate the negative effects, a student rocks forward, which can lead to accidents.

Advantages of a flexible chair seat:

Illus. 14: The flexible chair seat naturally adjusts to the weight shifting from front to back and supports a good posture.



Illus. 14: Do's

# Support resting and relaxing!



Illus. 17: Do's

Listening, thinking, relaxing, and having a conversation often require leaning back against the chair.

Disadvantages of a fixed chair seat:

Illus. 15: To alleviate the negative effects, the student leans back in the chair, which can lead to accidents.

Illus. 16: In a static seat the hips are fixed in the chair's trough, and the natural shift in seated postures is suppressed. This leads to static stress. In addition, body posture and cognitive performance decrease.

Advantages of a flexible chair seat:

Illus. 17: The flexible chair seat supports the distribution of weight from back to front. The angle of the hips opens up, and the torso is supported by the slightly reclined backrest of the chair.

# A frequent transition from sitting to standing is a must!

A frequent transition from sitting to standing is important, and more and more schools now provide students with adjustable height desks.



Illus. 18: SitandStand desk

Experience has shown that having at least one mobile and fully height-adjustable group table per room is very important. The table surface should be large enough so that four to five students can work together as a team. Activities such as reading, project-based learning, free work, and many kinds of collaboration can all be done more effectively when students are standing as opposed to sitting.



Illus. 19: Fully height-adjustable teacher's desk and/or group table.

Today and in the future we need solutions designed to support the body's intrinsic need for movement and variation so that students are encouraged to adopt dynamic body posture behaviors. Therefore, easy furniture adjustment from a seated to a standing position is important when switching from individual work to project-based learning in a team.

# The recommendation:

Students should not spend their entire school day sitting, but rather as follows:

- 50% sitting (dynamic sitting on flexible chairs)
- 30% standing (e.g. standing at desk)
- 20% walking around (e.g. teaching methods like active learning organization methods, and breaks which involve movement).



Illus. 20:

- Student desks with crank height-adjustment
- Student desks with inclinable table surfaces and two castors
- Mobile stand-at computer workstation
- Height-adjustable, flexible student chairs with 3-D rocking mechanism to allow movement to all sides (front to back and left to right)

# The next posture is the best posture!



Illus. 21: Teamwork while standing

Similar to standing freely and shifting weight from one leg to the other, the rhythm of sitting fluctuates between tensed and relaxed postures.

**Ergonomic furniture makes movement easy:**

Dynamic sitting provides students flexibility needed to expend energy and, at the same time, to focus on their work instead of having to focus on how to keep still.

The chair adjusts to the natural demands of the active body. It automatically stabilizes the angle of the hips that the body (or the activity) requires. Desks and tables that are easily adjustable in height also facilitate a change from sitting to standing or from individual work to teamwork.

The next body position is always the best. That means that in order to allow for frequent changes in a student's seated posture, VS chairs have a unique curved form that supports a more natural mode of sitting.



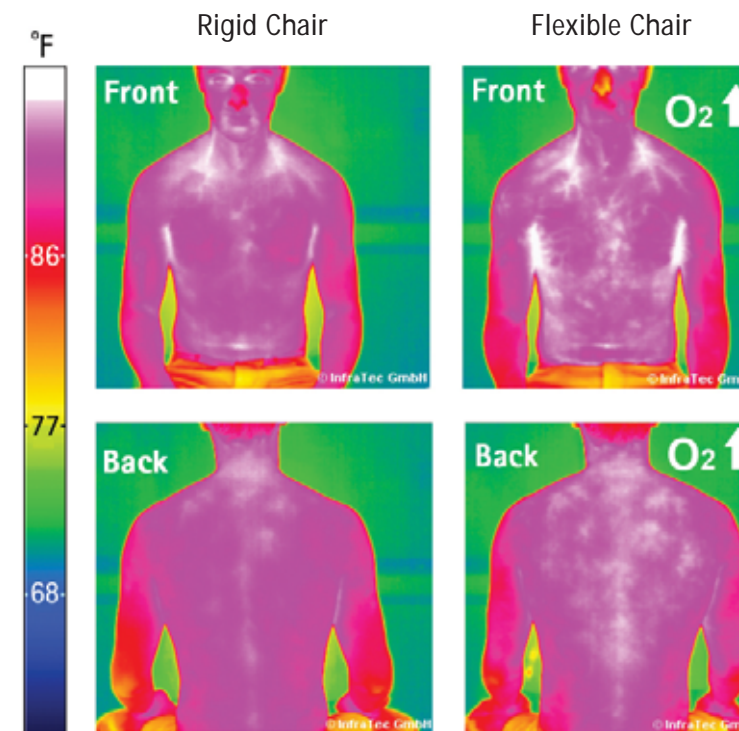
Illus. 22: Easy one-on-one communication



Illus. 23: Varied working postures

# More oxygen = Better thinking!

The flexible chair seat and the naturally dynamic functions of human beings constitute a system in which the legs are included in the range of movement. The advantage of active feet is that by activating the leg muscles the student improves the body flow to the heart and the brain. This advantage has been revealed in studies where students' upper body surface temperature has been measured thermographically.



Illus. 24: Above on the right hand side, you see a significant increase of oxygen supply while seated on a flexible chair, compared to a deficient circulation when seated in a rigid chair on the left hand side.

Cells need oxygen, transported by blood, to burn energy. Blood also carries carbon dioxide – waste from the body's burned energy – out of the cells. The effectiveness of this process is facilitated by tissue perfusion, a measure of the exchange of oxygen and carbon dioxide within the body's tissues. It's the basis for keeping individual cells, and ultimately human beings, alive.

**Physical and cognitive flexibility demands many posture changes and a lot of movement.**



Illus. 25: Human brain



Illus. 26: Active sitting