

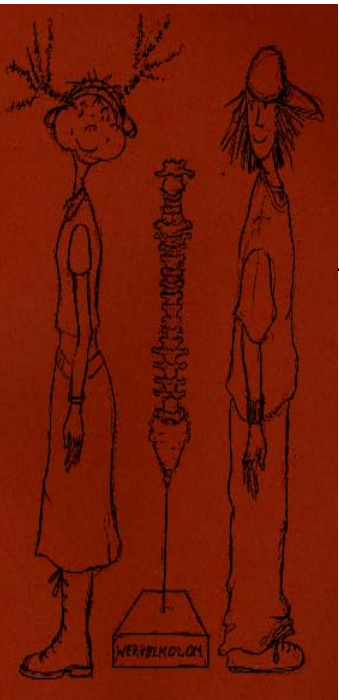
**The effects of a  
two-school-year  
multi-factorial  
back education program  
in elementary schoolchildren**

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**Prof Dr D De Clercq**

**Prof Dr I De Bourdeaudhuij**

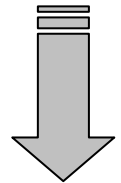
**Prof Dr G Cardon**



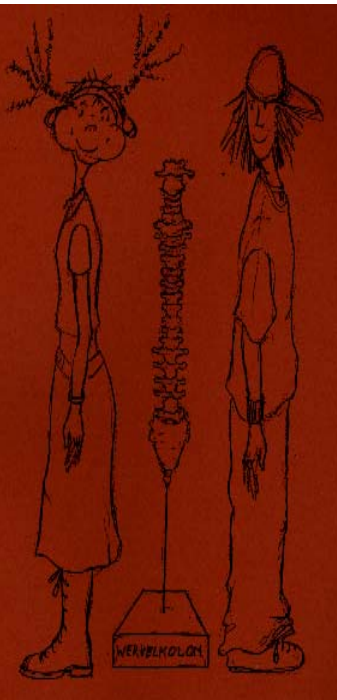
# INTRODUCTION

prevalence

- Epidemiological studies report mounting **back pain prevalence** among youngsters (Jones et al. 2003)
- **Back pain** occurrence is **recurrent** in a subgroup of children (Siivola et al. 2004)
- Back pain **at young age** may persist into **adulthood** (Harreby et al. 1999, Brattberg 2003)



**Research into the early stages** of the problem



# INTRODUCTION

risk factors

The **risk** for developing **back pain** at a **young** age

- ➔ multi-factorial (Balagué et al. 1999; Jones et al. 2005)
- ➔ causative mechanisms undetermined

Determination of risk factors for back pain in children

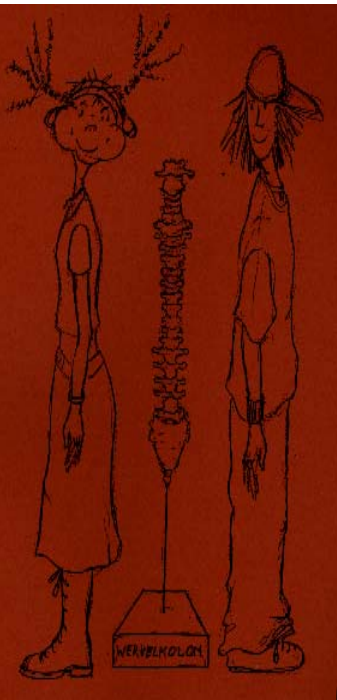
- ➔ complex / asks for discussion

- Cross-sectional: conflicting results (Cardon and Balagué 2004)



- Epidemiological evidence
- Biomechanical argumentation related to the concepts of 'spinal loading' (Mc Gill 2002)

**relation between loading and back pain = U-shaped**



# INTRODUCTION

school environment

## Risk Factors in the school environment

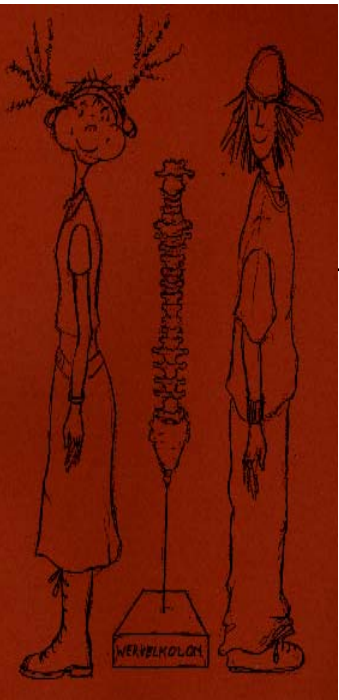
- research is limited
- exposes children to the possible loading factors
  - prolonged sitting (Murphy et al. 2004)
  - poor postures (Murphy et al. 2004)
  - absence of appropriate furniture (Panagiotopoulou et al. 2004)
  - back packs (Spalszki et al. 2002)

## Postural discomfort in schools



## Elementary school is an ideal setting for prevention

- optimizing environmental conditions
- prolonged feedback
- large percentage of the population
- elementary schoolchildren are receptive



# INTRODUCTION

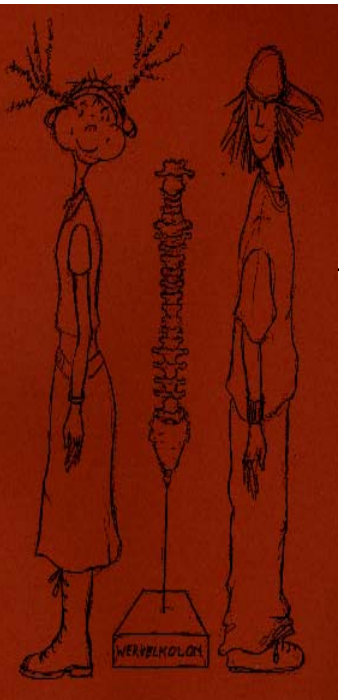
prevention

Effects of **school-based interventions** (Cardon and Balagué 2004)

- **only 5** school-based interventions
  - better use of back posture principles (Cardon et al. 2002)
  - increased knowledge (Cardon et al. 2002, Mendez et al. 2001)
  - improved general postural habits (Mendez et al. 2001)
- interventions are **promising** but **too limited** (COST B13 2004; Cardon and Balagué 2004)

**Shortcomings** of existing intervention studies

- little study sample
- short implementation time+ short term effect
- intervention by an expert



# INTRODUCTION

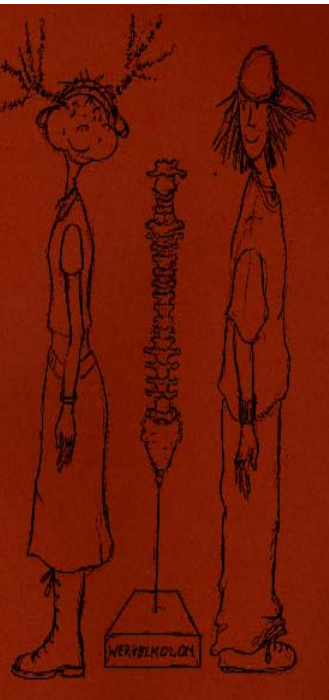
study aim

Present intervention study = optimized

- o the **multi-factorial** intervention started with back posture education sessions by an **expert**
- o the **class-teacher** continued the promotion of good biomechanics
- o the intervention persisted **two school-years**
- o the effects were investigated over a long term (2 school-years) in a **quasi-experimental design**

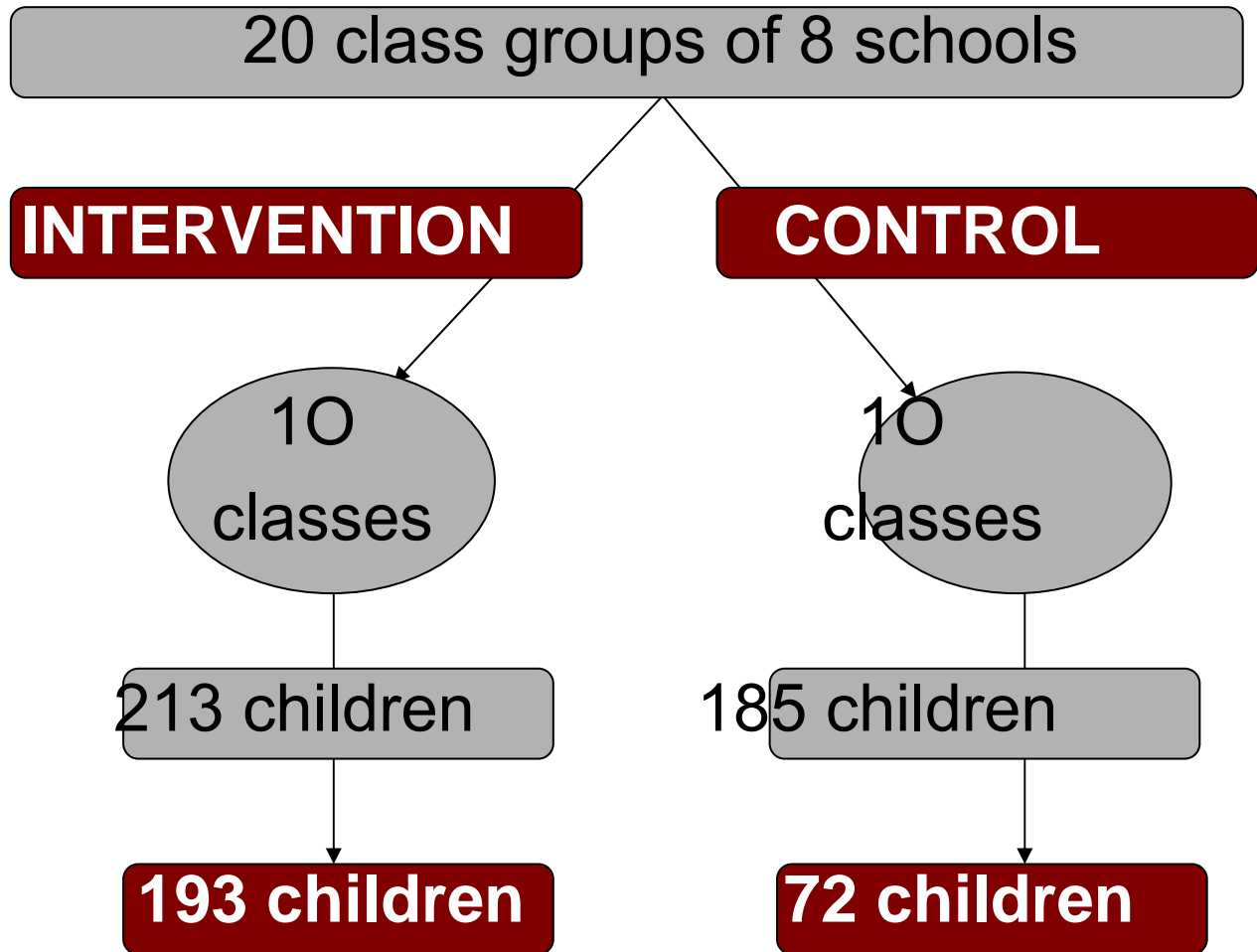
The **purpose** of the current intervention study

to evaluate the **effects** of the **optimized** multi-factorial **back education program** on **knowledge** and **postural behavior** in **elementary schoolchildren** in Flanders



# METHODOLOGY

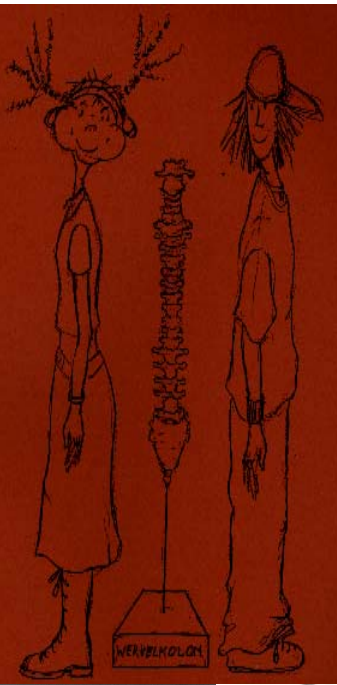
subjects



At pre-test :

*33 drop outs (9%)*

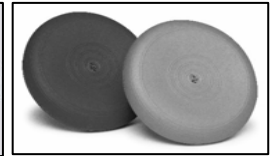
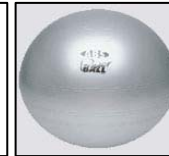
At post-test :



# METHODOLOGY

intervention

The multi-factorial intervention



**BACK EDUCATION**

Back posture principles

Skills

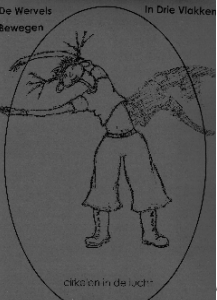
Reminders

Ergonomic material  
(4 elements)

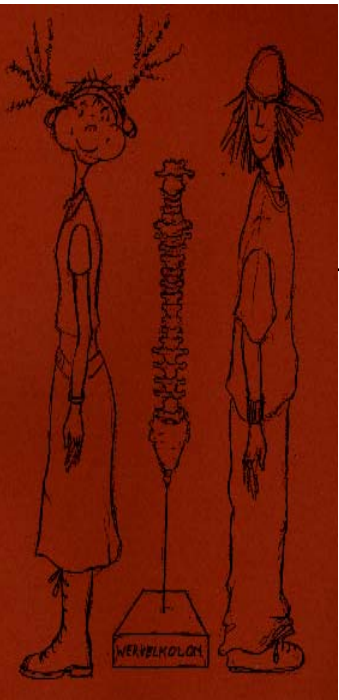
**ENVIRONMENT**

Movement breaks  
(daily / 2 times a day)

Movement stimulating  
environment  
(activating approach)







# METHODOLOGY

procedure

School year 2002-2003

4th and 5th graders

School year 2003-2004

5th and 6th graders

September-October

**PRE-TESTING**

November-June

**INTERVENTION**

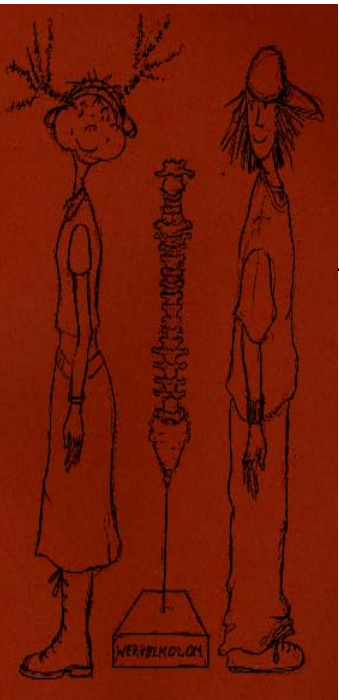
September-March

**INTERVENTION**

April-June

**POST-TESTING**





# METHODOLOGY

procedure

Evaluation (pre-post design)

## 1. questionnaire

intervention group n=156, control group n=161

## 2. observations of postural behavior

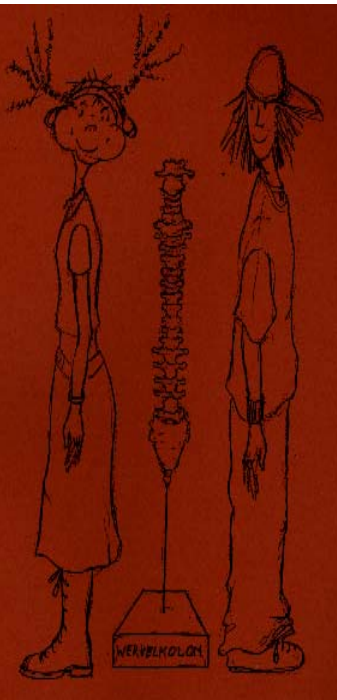
classroom (3 randomly selected children/class)

intervention group n=26, control group n=35

material handling

intervention group n=153, controls n=124





# METHODOLOGY

instruments

## 1. Questionnaire

### Specific and general knowledge

- 10 questions + multiple choice quiz of 11 questions
- output = score (max sp knowl=10 + gen knowl=11)

### Prevalence of back pain

- back or neck pain during the last week (intensity, frequency)
- output = 'pain' or 'no pain'

## 2. Observation

### Postural behavior in the classroom (PEO)

- registration of body postures and activities
- 30 minutes during a regular lessons (mathematics, language)
- output = percentages observed time interval (≠ categories)

### Material handling

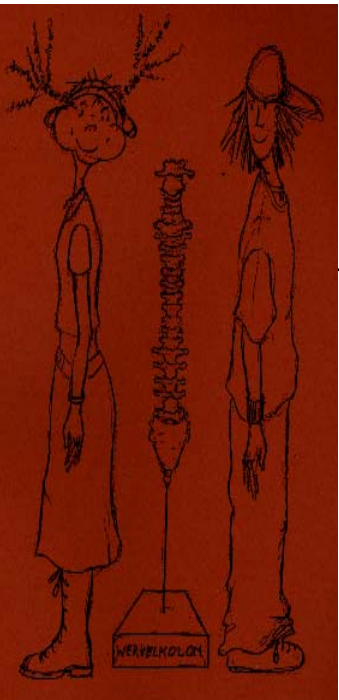
- encoding lifting tasks qualitatively
- 3 tasks: bench, light object, heavy object
- output = performance scores on biomechanical items

### Postures

Trunk flexion  
Trunk torsion  
Neck flexion  
Neck torsion  
Arm support  
Use of backrest

### Activities

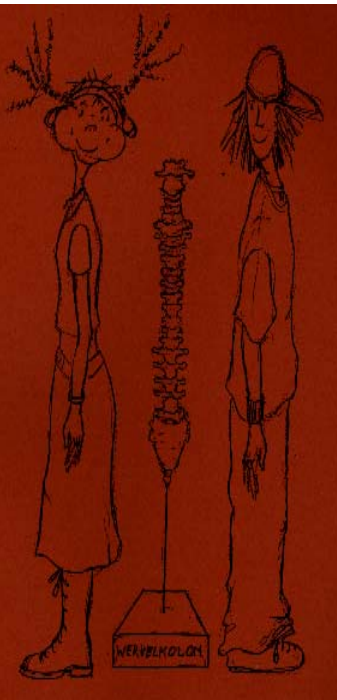
Static sitting  
Dynamical sitting  
Standing  
Walking around  
Reading/writing



# METHODOLOGY

data analysis

- SPSS 11.0
- Inter-rater agreement (PEO + material handling)
  - ↳ Intra-class correlation coefficients
- Effects of the intervention pre-post design
  - ↳ Repeated Measures ANOVA
    - Time = within-subjects factor  
*pre versus post*
    - Condition = between-subjects factor  
*intervention versus control group*
    - Gender = between-subjects factor  
*boys versus girls*



# RESULTS

inter-rater agreement

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Inter-rater agreement (2 observers)

## 1. PEO observation

For 7 categories: ICC's between 0.83 and 0.94

For 4 categories: lower ICC's (between 0.61 and 0.78)

## 2. Observation of material handling

For all categories: ICC's between 0.81 and 1.00

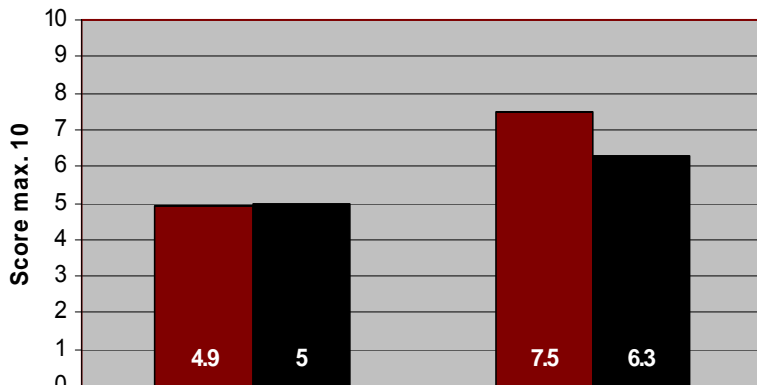
# RESULTS

(1) knowledge

A positive interaction effect for specific and general back posture related knowledge

➔ a significantly higher increase in the intervention group

SPECIFIC BACK POSTURE KNOWLEDGE



F=11.554

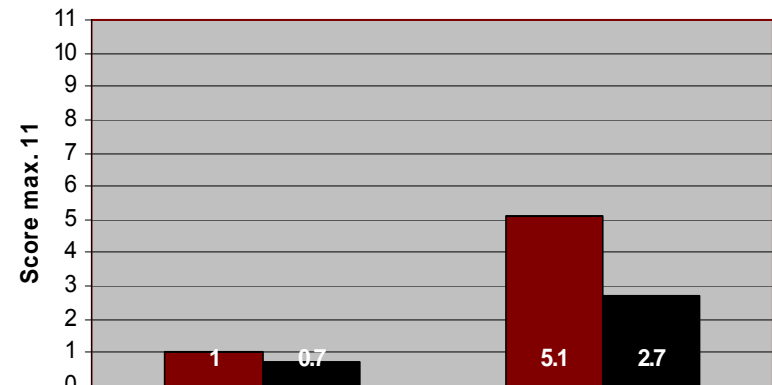
pre

post

P<.001

■ Intervention Group ■ Controls

GENERAL BACK POSTURE KNOWLEDGE



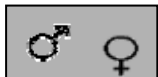
F=18.984

pre

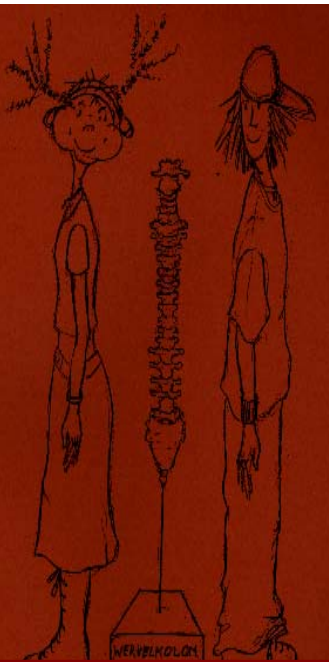
post

P<.001

■ Intervention Group ■ Controls



The effects on knowledge = boys and girls



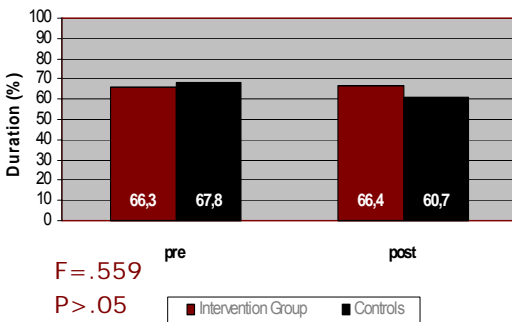
# RESULTS

## (2) observation in the classroom

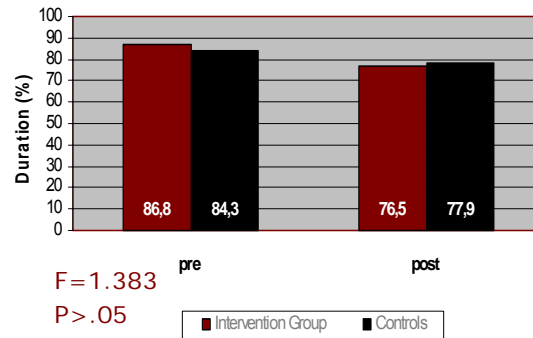
### 1. Activities during lesson time

No positive interaction effects for postural activities

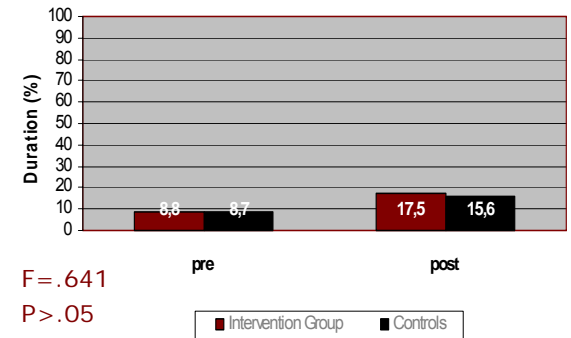
READING AND WRITING



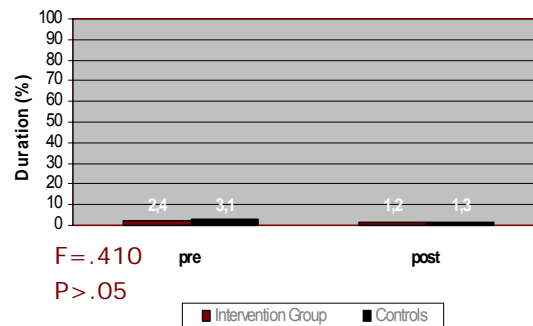
STATIC SITTING



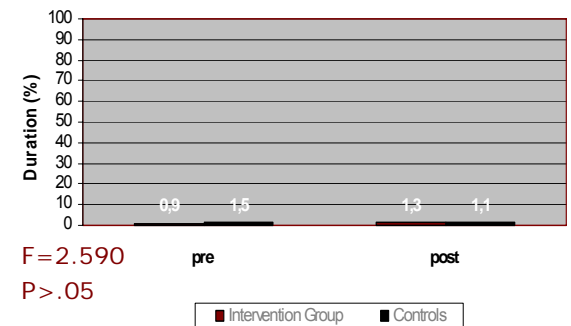
DYNAMIC SITTING



STANDING



WALKING AROUND



The effects on classroom activities = boys and girls

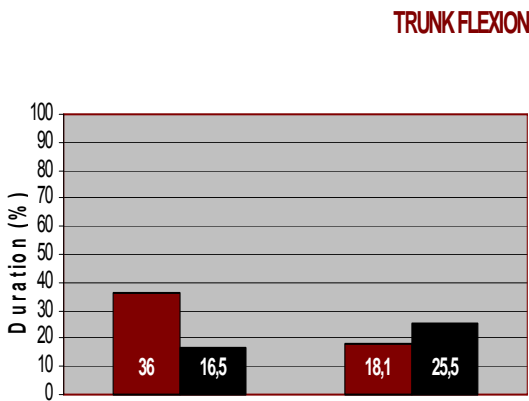
# RESULTS

## (2) observation in the classroom

### 2. Postures

Positive interaction effect for **trunk flexion** and **neck torsion**  
➔ a decrease in duration in the intervention group

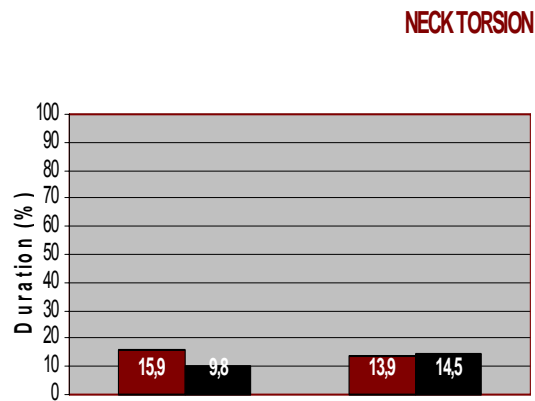
Tendency towards significance  
➔ **trunk torsion decreased** more in intervention group



F=8.931

P<.05

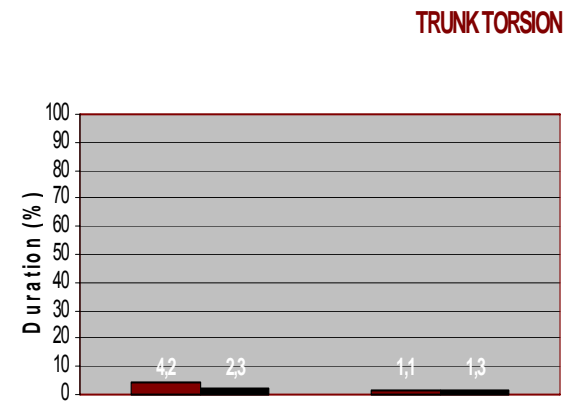
■ Intervention Group ■ Controls



F=4.207

P<.05

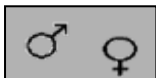
■ Intervention Group ■ Controls



F=3.452

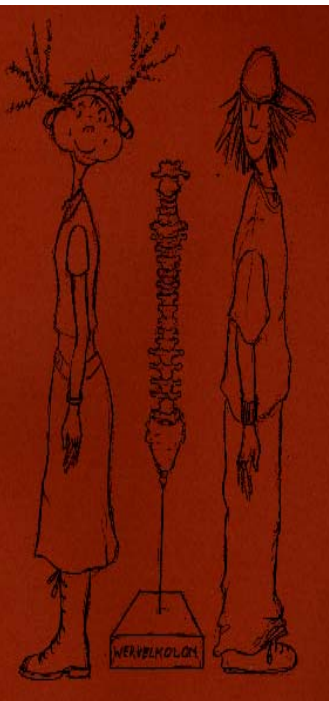
P<.07

■ Intervention Group ■ Controls



The effects on classroom postures = boys and girls





# RESULTS

## (3) observation of material handling

Positive interaction effects on **all** evaluated postural items

➔ intervention scored better on

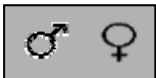
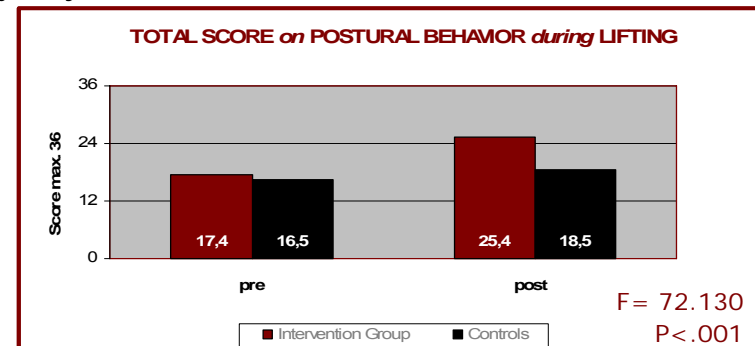
- 'knee bending while lifting a bench' ( $F=40.797, P<.001$ )
- 'knee bending while lifting a heavy object' ( $F=14.264, P<.001$ )
- 'knee bending while putting down bench' ( $F=55.299, P<.001$ )
- 'no twisting lifting a bench' ( $F=6.065, P<.05$ )
- 'no twisting putting down a bench' ( $F=21.855, P<.001$ )
- 'body posture while moving a bench' ( $F=9.115, P<.05$ )

➔ excepted for

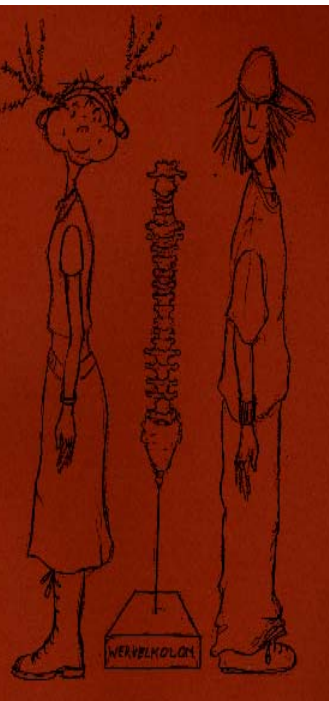
- 'back position while lifting a bench' ( $F=.027, P>.05$ )
- 'picking up a light object' ( $F=.167, P>.05$ )
- 'no twisting while moving a heavy object' ( $F=2.770, P>.05$ )

Positive interaction effect **total** score on material handling

➔ higher improvement intervention group



Effects on performing lifting tasks = boys and girls

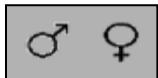
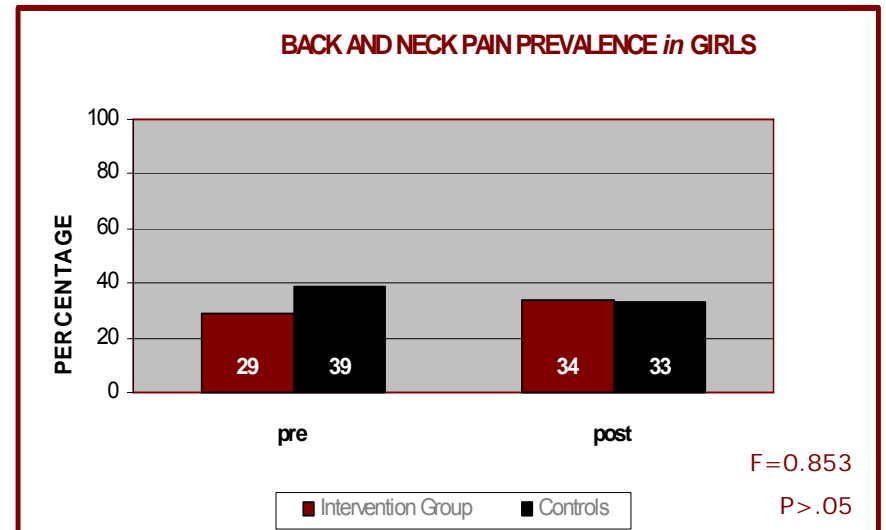
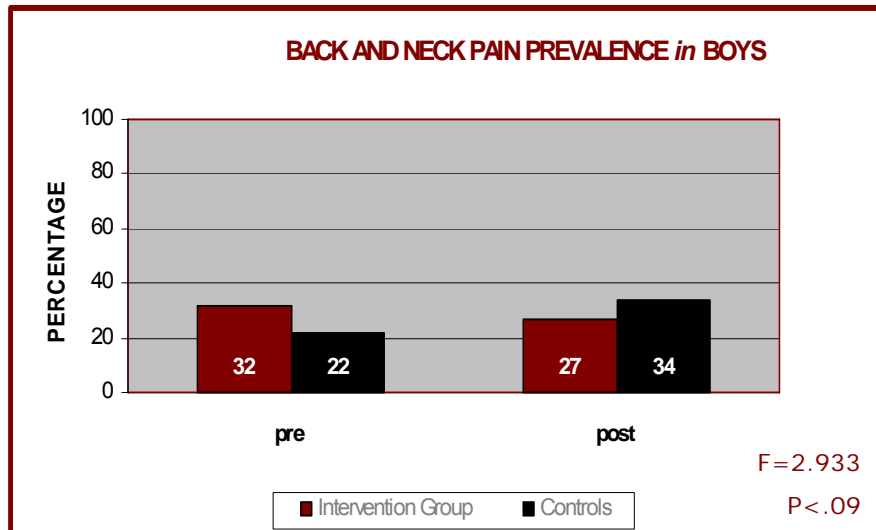


# RESULTS

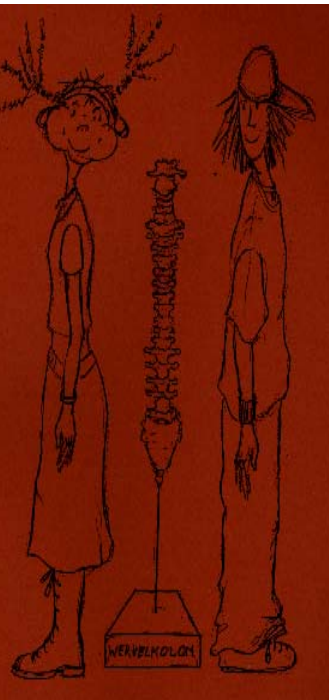
(4) prevalence

Tendency towards significance for back pain reporting

- ➔ lower in boys of the intervention group
- ➔ no significant interaction effect in girls



Trend self-reported back and neck pain  $\neq$  boys and girls



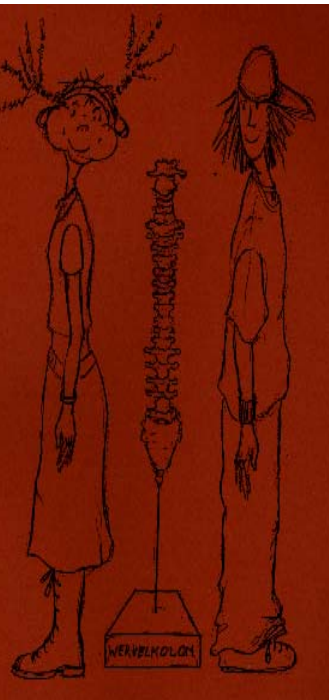
# RESULTS

(4) prevalence

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The self-reported pain within the last week was

- o a mild pain
- o occurring not frequently (only once or several times)

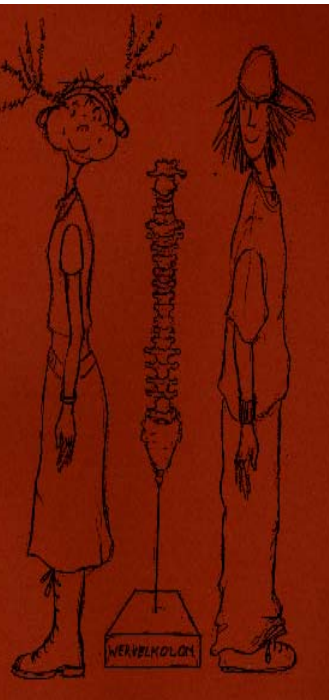


# DISCUSSION

intervention

The present multi-factorial back posture program

- over a **long term** (2 school-years)
- **promotion** of good body mechanics **continued** after back posture education (6 sessions by expert)
  - **environment**
  - **class teacher**
  - ergonomic material
  - movement breaks
  - activating approach (didactical guidelines)
  - reminders promoting good body mechanics

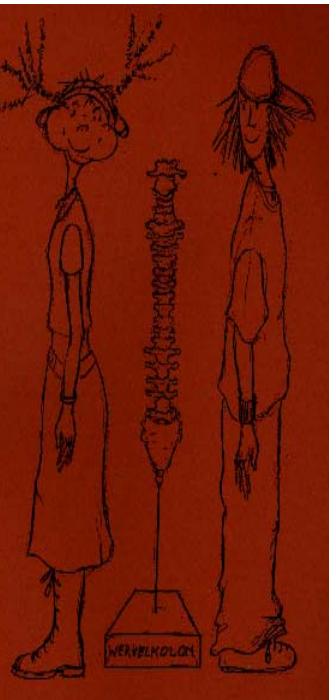


# DISCUSSION

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knowledge

The intervention resulted in **increased** general and specific back posture **knowledge**

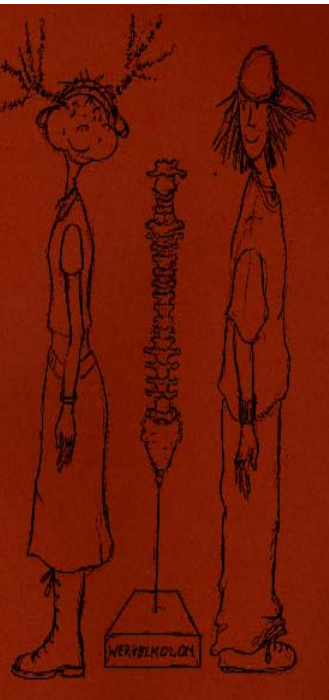


# DISCUSSION

material handling

Postural behavior during material handling improved conform to the learned skills

The remarkable evolution of the total score on 'handling material' in an unforced playing situation showed that the learned postural skills became generalized (cfr Mendez 2001)



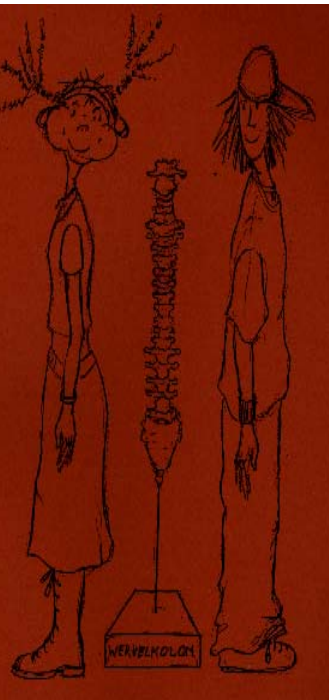
# DISCUSSION

classroom postures

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Sitting postures of children who participated in the intervention improved for trunk flexion and neck torsion

There was a trend for a decrease of trunk torsion in the intervention group



# DISCUSSION

## postural activities in the class

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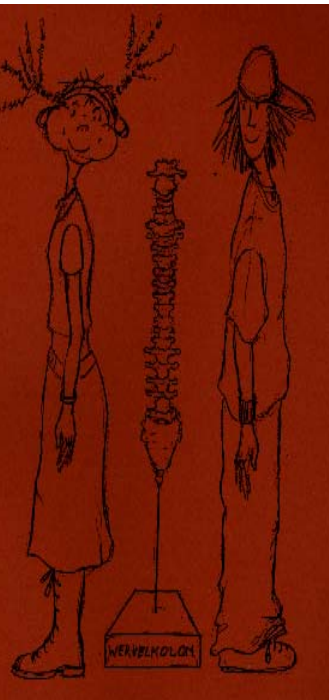
No increase in postural activities in the class

Absence of effect:

- Restrictions in classroom space
- Teachers difficulties to change traditional didactic
- Insufficient knowledge and experience cfr 'activating'

The inclusion of applied biomechanics in the professional training of future teachers with focus on the class environment and the role of the class teacher might play a part in the improvement of postural activity in the class





# DISCUSSION

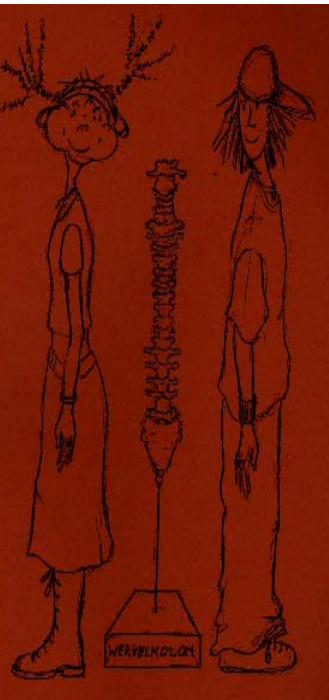
prevalence

After 2-year promotion for good body mechanics boys reported decreased back or neck pain compared to the control group

In girls the pain reports did not differ between the intervention and the control group after two years

One could question self reported back or neck pain as the right outcome of a back posture education program in elementary schools

Back pain prevalence could be approached as a long term intervention effect while the evaluation of a back education program should focus on the direct effects on knowledge and modifications in risk factors



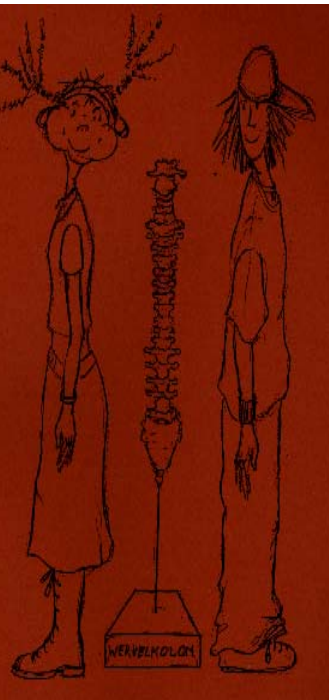
# DISCUSSION

conclusion

The current study findings demonstrated that several postural aspects *related to daily biomechanical load* improved

Back posture education through the school curriculum seems to be an effective strategy to promote good biomechanics in a young population

The long term effect of improved postural behavior at young age on back pain prevalence later in life is of interest for future research



# THANK YOU !

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THIS STUDY WAS PART OF A BROADER RESEARCH PROJECT ENTITLED SPORT, PHYSICAL ACTIVITY AND HEALTH, CARRIED OUT BY THE RESEARCH CENTRE, AND FUNDED BY THE FLEMISH GOVERNEMENT.

