ISRCTN15982336 https://doi.org/10.1186/ISRCTN15982336

Effects of indoor daylight control on middle school students

Submission date	Recruitment status	[ ] Prospectively registered
15/06/2020	No longer recruiting	[ ] Protocol
Registration date	**Overall study status**	[ ] Statistical analysis plan
28/07/2020	Completed	[ ] Results
Last Edited	**Condition category**	[ ] Individual participant data
28/07/2020	Other	[ ] Record updated in last year

Plain English summary of protocol

Background and study aims
Natural light is changing in intensity and spectrum during the day. Experiencing it is a crucial factor, influencing the circadian rhythm cognitive performance, concentration and daytime sleepiness. This is also true for students. Intelligent shading systems can improve the indoor daylight supply. This controlled, single-blinded longitudinal intervention study investigated the effects of a new shading system on cognitive performance, stress and wellbeing in healthy middle school students.

What does the study involve?
New shading systems will be installed in four classrooms of the middle school of Adnet (Salzburg, Austria). In two classrooms conventional shading systems will be installed (control-condition). The other two classrooms will be equipped with the new shading system. This new shading system leads much more daylight into the building, than conventional systems, while reflecting direct sunlight to prevent the building from overheating. During the intervention period, all children will live at home, maintaining their usual lifestyle. Participating students will be asked to perform a concentration test, to fill out some questionnaires and salivary samples will be collected.

Who can participate?
Only students from the 7th and 8th grade of the middle school of Adnet, Salzburg, Austria can participate in this study.

What are the possible benefits and risks of participating?
No risks are expected.

Where is the study run from?
The Paracelsus Medical University of Salzburg (Austria)

When is the study starting and how long is it expected to run for?
January 2015 to June 2016

Who is funding the study?
This project is funded by Salzburg state (funding scheme: Trans4Tech)

Who is the main contact?
Dr Arnulf Hartl

Contact information

Type(s)
Scientific

Contact name
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Additional identifiers

Clinical Trials Information System (CTIS)
Nil known

ClinicalTrials.gov (NCT)
Nil known

Protocol serial number
415-E/1857/2-2015

Study information

Scientific Title
Physiological and psychological effects of indoor daylight control on middle school students

Acronym
Trans4Light

Study objectives

Primary Hypothesis: An increased indoor daylight supply improves cognitive performance, quality of life and stress in middle school students.
Secondary Hypothesis: An increased indoor daylight supply in classrooms reduces power consumption.

Ethics approval required
Old ethics approval format

Ethics approval(s)
Approved 16/03/2015, Ethics Committee of Salzburg (Stefan-Stief-Gasse 2, Postfach 527, 5010 Salzburg, Austria; +43 (0)662 8042 0; ethikkommission@salzburg.gv.at), ref: 415-E/1857/2-2015

Study design
Controlled single-blinded longitudinal intervention study with two intervention groups and constructive implementation

Primary study design
Interventional

Study type(s)
Quality of life

Health condition(s) or problem(s) studied
Cognitive performance, quality of life and stress in middle school students

Interventions
New shading systems were installed in four identical classrooms in the selected middle school. These shading blades prevent the building from overheating in summer months. Common blades (schlotterer 80R) were installed in two classrooms, while two classrooms were equipped with shading blades in a special design (schlotterer RETROLux 80D), which enables them to reflect more daylight into the rooms. All students, parents and teachers were blinded. The RETROLux 80D blades block direct sunlight in summer, while reflecting more non-direct daylight than conventional shading systems. The participating students spent on average 5 days per week and 5-8 h per day in their classrooms. During the intervention, all children lived at home, maintaining their usual lifestyle.

One class of each grade was randomly assigned to the special shading system. The intervention time was 3 semesters (~1.5 years). During the intervention time of 1.5 years, data was collected at five timepoints:
T1 = baseline, March 20; T2 = June 2015; T3 = November 2015; T4 = March 2016; T5 = June 2016.

Intervention Type
Other

Primary outcome(s)
1. Salivary cortisol (as a biomarker for stress) measured by ELISA at T2-T5
2. Salivary melatonin (as a biomarker for circadian rhythm) measured by ELISA at T2-T5
2. Daytime sleepiness assessed using the Pediatric Daytime Sleepiness Scale (PDSS, German translation) questionnaire at T1- T5

T1 = baseline, March 20; T2 = June 2015; T3 = November 2015; T4 = March 2016; T5 = June 2016.

Key secondary outcome(s))
1. Attention and concentration assessed using the d2-Revision (d2-R) test at T1-T5
2. Health-related quality of life in children assessed using the KINDL-R questionnair at T1-T5
3. Stress processing assessed using the German Coping Questionnaire for Children and Adolescents (SVF-KJ) questionnaire at T1-T5
4. Participant's assessment of stress measured using an inverse visual analogue scale measured every week during the intervention period of 3 semesters
5. Participant's assessment of daytime sleepiness measured using an inverse visual analogue scale measured every week during the intervention period of 3 semesters
6. Participant's assessment of concentration measured using an inverse visual analogue scale measured every week during the intervention period of 3 semesters
7. Participant's assessment of wellbeing measured using an inverse visual analogue scale measured every week during the intervention period of 3 semesters
8. Participant's assessment of fatigue measured using an inverse visual analogue scale measured every week during the intervention period of 3 semesters
9. Daylight and artificial light composition measured using a spectrometer continuously throughout the intervention
10. Indoor carbon dioxide concentration measured using a CO2-meter continuously throughout the intervention
11. Room temperature measured using a digital hygro-thermometer continuously throughout the intervention
12. Relative humidity measured using a digital hygro-thermometer continuously throughout the intervention
13. Power consumption measured using a power meter continuously throughout the intervention

T1 = baseline, March 20; T2 = June 2015; T3 = November 2015; T4 = March 2016; T5 = June 2016.

Completion date
23/06/2016

Eligibility

Key inclusion criteria
Students of the 7th and 8th grade of the Middle School of Adnet (aged 12-15)

Participant type(s)
Healthy volunteer

Healthy volunteers allowed
No

Age group
Child

Lower age limit
12 years

Upper age limit

15 years

Sex
All

Total final enrolment
85

Key exclusion criteria
Students of the 5th and 6th grade of the Middle School of Adnet

Date of first enrolment
17/03/2015

Date of final enrolment
17/04/2015

Locations

Countries of recruitment
Austria

Study participating centre
Paracelsus Medical University Salzburg
Institute of Ecomedicine
Strubergasse 22
Salzburg
Austria
5020

Sponsor information

Organisation
Paracelsus Medical University

ROR
https://ror.org/03z3mg085

Funder(s)

Funder type
Government

Funder Name
Salzburg state (funding scheme: Trans4Tech)

Results and Publications

Individual participant data (IPD) sharing plan
Data can be requested from Arnulf Josef Hartl (arnulf.hartl@pmu.ac.at). Data will be available as an Excel sheet and will be shared by email. The data is fully anonymised by 4-digit ID. Consent from participants was obtained to use their data for scientific purposes only. Data will be only accessible for scientific research (e.g. power calculations, meta-analysis).

IPD sharing plan summary
Available on request

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Participant information sheet	Participant information sheet	11/11/2025	11/11/2025	No	Yes