THEORY AND PRACTICE IN APPLIED SPORT SCIENCE

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Aim

To present different examples how Sport Science can be integrated with practice in sport education and training

To briefly describe different types of research methods related to sport science

Lecture design

1. Wrestling

2. Physical activity & neuro-motor training in physical education & sports

3. Cross-country skiing and Alpine skiing

4. Wheelchair racing
WRESTLING

Analysis of physical demands in Graeco Roman style wrestling World Championships 1998 & 1999

- Work time profile
- Blood lactate accumulation
- Rated Perceived Exertion RPE
Work time intervals

Rest time intervals

- Blood lactate accumulation
- High intensity aerobic work load
High RPE in forearm muscles

Specific endurance strength training for "grip" muscles

Wrestling = "double metabolism"; Local muscular endurance
General aerobic endurance
• “Local” endurance
• General endurance
• Leg muscle endurance strength to push opponent forward
• High mean power level

Power = Force • velocity

\[ P = F \cdot v \]
The Power Box

Prototype 1

Prototype 2

Prototype 3

- Specific leg muscle endurance strength
- Simultaneous feedback
- Logging of training performance
• The lift capacity is important for performance in wrestling

• Muscular power: \( P = F \cdot v \); Absolute strength and speed
The Power Lift

• Specific lift power training
• Direct feedback on relevant parameters
• Logging of training performance
Qualitative analysis of technique learning

- Digital video & video analysis software
- Feedback on important details in movement technique
Physical Activity & neuro-motor training in Physical education & Sports
Motor activity - children play - motor development

R = Break
T = Theory lesson
I = Physical education lesson
Heart rate (beats/minute)

Level: Grammar  Junior High  High
Motor activity lesson

- To study spontaneous and directed motor activity
- To study and develop motor functions during play

Route & motor activity choice

Bird perspective
• Quantity of training = necessity for motor development
• How many repetitions are acceptable for a well designed lesson
• Quality analysis
Skiing playground
Combination training: Motor skill & aerobic training

Volleyball
GIH Motor Lab

Stimulate spontaneous motor activity

Screening test for teachers a o
The Music Motor Plate

- Motor development with music
- Stimulate people with low motor function to perform music
- Increase motor activity among children and adults
• Pedagogical dual action
• Combined motor & aerobic training
Cross-country skiing and Alpine skiing
Cross-country skiing – Double poling

- Which is the technique of the best skiers?
- Is there a typical co-ordination pattern?
- Effektive ways to test and train double poling
- Need for precise feedback
EMG-pattern, activation level and joint angular displacement during double poling

- Elite cross-country skiers
- Double poling at different speeds
- Video recording
Three step rocket

Step 3

Step 2

Step 1

Beginning of thrust

End of thrust

The winner of the Wasa race
CENTRAL PROCESSOR

MOVEMENT PATTERN GENERATION

- Time of activation
- Activation level
Further studies on DP technique

2D and 3D movement analysis

- Pole forces
- Joint torques
- EMG
Raw recording from elgons and EMG & video sequence

Hip angle
Knee angle
EMG Rectus femoris
EMG Rectus abdominis

Ext. Flex.
Sequential activation
Order of EMG peaks

Three step rocket
The double poling ergometer

- Need for testing double poling (DP) performance
- Need for a training apparatus giving detailed feedback

The feeling and technique close to DP on skis
A more detailed knowledge of power production in DP
Strong correlation between short time
Power production and endurance power

Specific strength important for DP
endurance?
Teorin om betydelsen av stor styrka för hög medeleffekt

Typ I
Typ IIa
Typ IIx

Mean power demand

Strength vs Endurance

Strength for power

Mean power demand

Theory: The importance of high max strength for high mean power and low relative load
• When and how much are the quads (VL) activated in Telemark skiing and dryland exercises?

• Strength specificity in: - Muscle action
  - Joint angle amplitude
  - Angular velocity
• Elite male Telemark skiers
• Electromyography  EMG
• Electrogoniometry
• Insole pressure
- Telemark skiing
- Telemark jumps
- Barbell squats
- Joint angle amplitude
- Angular velocity
- EMG activation level
ECCON - Apparatus for test and training of eccentric and concentric leg muscle strength

- Bilateral force recording
- Direct force feedback
- PC data logging
Wheelchair racing
Aim

- Learn more about the muscle coordination pattern in wheelchair racing
- Learn more about speed dependence in muscle coordination and EMG amplitude
Competition technique - muscle activity

- Elektromyography - EMG
- Tric. Brachii
- Bic. Brachii
- Pectoralis major
- Latissimus dorsi
- Elbow angle
- Trunk angle
• Speed registration: Laser camera + speed logger

• Video filming
Wheelchair movement cycle

![Diagram showing the movement cycle of a wheelchair with EMG data for different muscle groups and percentage values for each phase.]

- **Phase 1**: Driftas (start of movement phase) with Testhastighet 65%.
- **Phase 2**: Pendeltäta (pendulum phase) with Testhastighet 75%.
- **Phase 3**: Testhastighet 85%.
- **Phase 4**: Testhastighet 100%.

Muscle groups analyzed include:
- EMG Bic. br.
- EMG Tric. br.
- EMG Pect. maj.
- EMG Lat. dorsl
Speed versus EMG amplitude

Relativ hastghet % vs. EMG amplitude for different muscle groups:
- EMG Lats dxt
- EMG Pect dxt
- EMG Tric br dxt
- EMG Bic br dxt
The End