Typical and Atypical Motor Development and Motor Learning in Children

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Exploring Fundamental Movement Skills Across the Lifespan
Typical Motor Development
A Day in the Life

- Take any age
- Go through what happens in a day from getting up to going to bed
- List the activities that are non motor!
- Motor activities are the only way in which we interact with both others and the environment

- The fact is that hardly anything happens without the involvement of the motor system!
Motor Development

- Motor development is a change and is lifelong
- It is non linear with spurts and plateaus
- Changes that occur include:
  - Addition
  - Substitution
  - Modification
  - Inclusion
  - Mediation
The Two Major Questions in Motor Development

- How do children develop? This is the easier: how to describe children’s development.

- Difficult one—explain the mechanisms of change—why does change take place?

- Both have answers which influence intervention:
  - the first one gives indications of what to teach/use in therapy
  - the second one how to teach/use in therapy

- Question—I have always wanted to know the difference between teaching and therapy—for me both about learning. Anybody know?
Possible Answers to Explanation Question

- **Neural** - gradual unfolding of neural mechanisms-traditional theories

- **Information processing** - plans, schemas, input through to output models

- **Experiential** - recent evidence from researchers such as Adolph show us the huge importance of experience.

- **Dynamical systems** - brings all of the above together into multiple subsystems, self-organisation, environment-animal match, linear and non-linear changes.
MotorDevelopment-Birth to two years

We engage in examining this part of a child’s life because firstly many of the children we see are developmentally young and secondly it gives us some indications of progressions.
Motor Development—Birth to Two years

- Reflexes
- Spontaneous movements
- Postural control
- Locomotion
- Manual control
- Achievements plus qualitative changes
Motor Development-two to seven years

- Body control
  - Walking
  - Running
  - Jumping
  - Hopping
  - Throwing
  - Balancing
  - Catching
  - Slow and fast movements

- Again ages and stages-how accurate are –range and variability?
Motor Development-two to seven years

- **Manual skills**, including writing and drawing, self help skills.

Why do you think a child can make a square from matches before they can draw it?

- **Spatial and temporal accuracy** - why is this so difficult for young children and how does it direct our teaching and therapy?
There is an argument that says that by seven years of age a child has acquired all of the naturally developing skills s/he will ever have. After that period, they are refined, used for maximum performance, played with and utilised in novel situations. But no totally new ones emerge. Can you think of any?

If true, this period of a child’s life is crucial. Implications for therapy and PE in nursery and primary Schools.
Motor Development-seven to puberty

- Essential that fundamental skills are in place
- During this period children start to refine skills, play with skills in different situations, combine them, social and recreational play
- Maximum performance starts to play a part
- Gender differences—**biological or cultural—examples?**
- Spatial and temporal accuracy starts to play a major part and during this period it is one area that improves significantly both in terms of prediction and performance

How great are gender differences pre-puberty—where are they shown and if there are any, why?

Implications for therapy and PE in primary schools?
A number of children will have difficulties in movement and one can place them into two large categories:

- Those with motor difficulties as a primary defining condition
- Those with motor difficulties as a secondary defining condition
Motor Impairment

Motor difficulties as a primary defining condition:

Cerebral palsy

Developmental Coordination Disorder

Other?
Motor Impairment

Motor difficulties as a secondary defining characteristic:

Learning difficulties- general/specific
Sensory difficulties- sight/hearing/other
Behaviour difficulties
Other-ASD

The following slides are a short introduction to one of the above-DCD
Developmental Coordination Disorder

- **Historical journey** - ‘Clumsy’ ‘dyspraxia’ DCD X Brazil

- **DSM IV Criteria** - why –because we have to have some consistency

- **Co-morbidity** - particularly with other developmental disorders

- Why is it an issue? Here and now.
Diagnostic Features (DSM IV-TR; APA 2000). ICD 10 (WHO) is similar but one or two differences

Criteria

A. Marked impairment in development of motor coordination

B. Significantly interferes with academic activities or activities of daily living

C. Not due to general medical condition (CP eg)

D. If mental retardation is present motor difficulties are in excess of expectation.

See Leeds Consensus Statement 2006
Prevalence- depends how you measure it-if you use guidelines for MABC you will get 5%! Normal way in many other disorders is to take 2 SDs. Lingham 2-4% (2009)

Age effect- most studies 6-12. So what are they 3-5 and what are they post school age. Loads of potential for work. Bridgend/Newport work. Jan Piek; Mary Chambers; Amanda Kirby.
Progression- do children grow out of it? Studies show some do many don’t! Data on recent 4 year longitudinal study-group, subgroup, individual analysis

Gender difference- range of incidence differences from almost the same to 3 or even 4 times to 1 in ‘favour’ of boys. I would go with 2 to 1. Why?
Co-occurring Characteristics

- Examples: ADHD 60% (Ramussen & Gillberg 2000); SLI 60%, (Hill, 1998); Reading difficulties 55% (Kaplan et al, 1998); social, emotional and behavioural difficulties 82% (Losse et al, 1991).

- Figures differ depending on clinical or population samples.

- Effect of co-occurring characteristics on outcomes and planning for intervention
Co-occurring Characteristics

- Attention difficulties
- Literacy difficulties
- Social problems
- Organisational problems
- Planning problems

Are these co-occurring or are they features of the condition?
Planning and Execution

- Footprint study-with Amanda Kirby and Lisa Roberts

- Problem solving-planning and executing ‘crossing the river’
- Allows choices in natural contexts using natural tasks
- Quantitative and qualitative data-video
- Travel from one line over a ‘river’ to next line
- Do not fall in!
- As few strides as possible
- Continuous
Rod Wielding Study-Dynamic Touch

- With Amanda Kirby, Lisa and Angela-taking work of Turvey, Solomon into children
- Characteristics of unseen rod-eg length, weight, shape through wielding-dynamic touch-movement oriented.
- Nature of the variables that are being attended to.
- Use of more functional implements such as sports rackets.
- 43 TDC 13 DCD-all aged 9-11.
Results

- Consistent underestimation which increased with rod length but similar when taken as a proportion of rod length.
- DCD children - surprisingly as good as tdc-so what is going on?
- Scaled: TDC 47% DCD 39%
- ‘Weight’: Both groups over 75%
Mean values for rods

![Graph showing mean values for rods with TDC and DCD lines.](image-url)
Developmental Coordination Disorder

- **Overall picture:**
  - Motor core
  - Affects academic or activities of daily living
  - Co-occurring characteristics
  - 2-5% prevalence
  - More boys than girls
  - Stays with child without intervention
  - Symptoms change
  - Most work 6-12 but recent work on 3-5 and adults
  - Heterogeneity of profiles suggesting individual assessment and intervention

  - **ASSESSMENT and INTERVENTION** later in workshop
Why Motor Learning?

- Children’s learning is the end product of what we are trying to achieve.

- Children with movement difficulties by definition have not learned effectively - reasons may vary.

- It is the **outcome/dependent variable** - the one we measure and can see the results of.

- Our methods are **independent variables** - how can we best use therapy or teach so that the children learn.
What is Learning?

Schmidt and Lee (2005)

“a set of internal processes associated with practice or experience leading to a relatively permanent change in the capability for skilled behaviour”. (Page 320).

Let take this to pieces and see what it means for our work
What is learning?

“a set of internal processes..”

- You cannot see learning – only infer it from performances at various moments in time.
- Performances are one shot occurrences and liable to temporary influences.
- Capturing numerous performances gives an indication of learning.
- Performances can be deceiving!

This difference between performance and learning will permeate the work of the day.
What is learning?

- “associated with practices or experiences..”

- **Practice** has a formality about it with a definite intention to learn-e.g. an OT session.

- **Experience** is more informal learning that we do in our daily lives-children with difficulties are not so skilled at this.

- **Maturation** is not part of learning-it is part of development

- **Handwriting exercises are practices; writing a diary is experience.** Both are important
What is Learning?

“leading to a relatively permanent change in capability for skilled behaviour.”

- Relatively permanent-not a temporary feature-but ..
- It is not in performance-it is in the ‘capability’. So the performance can drop off but re-learning should be easier if it was learned in the first place
So Why is all this Important for Teaching and Therapy?

- If performance has not improved don’t assume there is no learning.
- Wait ...but not too long
- If performance has gone down-don’t assume it is lost-it is the capability that is learning
- Also don’t get over excited about performance-it can exaggerate skill level and may be temporary.
Performance Characteristics of learning

- Improvement/accomplishment of skill - *CP child now picks up cup*
- Consistency in performance - *reaching success now 80% previously 40%*
- Stability in performance - *reaches around objects on table for cup*
- Adaptability in performance - *different sizes and shapes of cups, in others houses*
- Performance more smooth with less effort - *less tremor, smooth and accurate*
- Parts become wholes - *one action, no longer reach and then grasp. Cf driving*
- Skill becomes more automatic - *do other actions at same time, argue with brother.*
- Coordination dynamics change. *Freezing to freeing degrees of freedom-less rigid, more flexible; but cup of water or painting window, walking on icy pavement. Task dependent*
- Persistence - 'stickability’
Stages of Learning

- Fitts’ 3 Stages:
  - **Cognitive stage** - understanding the demands of the task; crude attempts at practice
  - **Associative stage** - now understands and refining skill through trial and error and practice with appropriate feedback
  - **Autonomous stage** - skill is virtually automatic-can do other things at the same time.

- What are the implications of the stages for:
  - Instructions
  - Demonstrations
  - Explanations
  - Feedback
Feedback

- One of the most important variables in learning a skill with mounds of literature to back it up.

- Various types:
  - Intrinsic feedback
  - Augmented feedback
  - Knowledge of results
  - Knowledge of performance
Conditions of Practice

- Distribution of practice- *mass versus distributed.*
- Whole versus part learning-*when to break down or teach whole*
- Instructions, demonstrations, explanations and feedback
- Specificity and variability of practice-*class of events*
- Mental rehearsal-*what is it, planning, execution*
Motor Development and Motor Learning

*How to take what we know and apply it to intervention.*

*Workshop*