

2P84 Lecture:
Fundamental Motor Skill
Development

Introduction to Fundamental Motor Skill
Development

Movement patterns

- Basic functional structure of a fundamental motor skill (jump, gallop, slide, skip, hop...).
- Series of movements organized in a particular time-space sequence.
- Common elements are observable in more than one motor skill.

Skill Progression:

- From minimal form (2-3) to mature form to sport skill form (6-12 years).

What Fundamentals?

stability (Non-Locomotion) – Balance, Twisting, Bending...

Locomotion – Run, Jump (Long/Up), Hop, Gallop, Slide, Skip, ...

Manipulative (Object-Control) – Catch, Throw, Kick, Dribble, Strike...

and eventually combination of the Above (e.g., Run, Dribble, Jump, and Throw)

Benefits of Competency in
Fundamental Skills

(e.g., Lubans et al., 2010; Stodden et al., 2008)

- Behavioural Benefits
 - Higher levels of physical activity
- Physiological Benefits
 - Lower BMI levels
 - Higher cardio-respiratory fitness levels
- Psychological Benefits
 - Higher levels of perceived physical competence

- associated with higher levels of activity

object-control skills are particularly linked to physical activity and health related fitness in late childhood and adolescence

The State of FMS in Children

(Vandaele et al., 2011)

In general, it is assumed that FMS are established between 4 and 6 years of age and should be mature by age 6.5 (Gallahue and Ozmun, 2002), however, there is a surprisingly low prevalence of FMS mastery among third and fourth grade children so FMS mastery among children is in need of improvement.

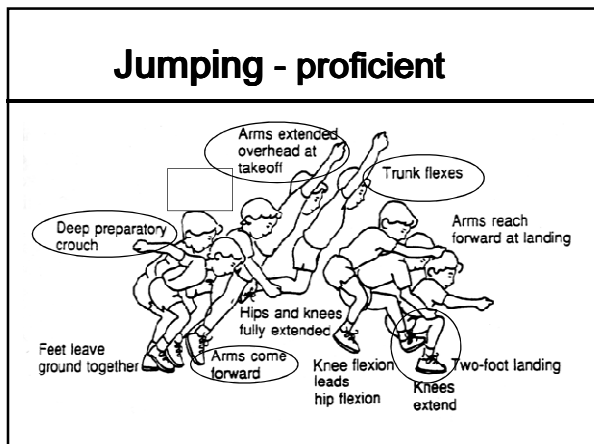
The Development of Fundamental
Stability and Locomotor Skills

RUNNING

- Natural extension of walking but different
- Characterized by an alternate (not double) support phase and flight phase
- Requirements:
 - Adequate lower limb strength to propel body through air and to handle the additional force encountered when the airborne foot strikes the supporting surface
 - Improved motor coordination to control the moving legs

a key window for fms development is before age 10.

| | |
|------------------|-------------------|
| girls | boys |
| - hop | - run |
| - kip | - jump |
| - static balance | - throw |
| - 2 handed catch | - strike and kick |



- how they progress from basic to expert

Jumping - proficient

- Vertical jumping and horizontal jumping are most often studied in children
- Phases
 - Preparatory phase
 - Takeoff phase
 - Flight phase
 - Landing phase
- The advanced jumper fully extends the body during the takeoff phase
- The advanced jumper absorbs the landing forces by flexing the knees, hips, and ankles at impact

Jumping

- Early: Vertical component of force may be greater than horizontal. Jump is upward rather than forward. Arms move backward, acting as brakes to stop the momentum of the trunk as the legs extend in front of the center of mass.

Age at which 60% of boys and girls are able to perform at a specific level

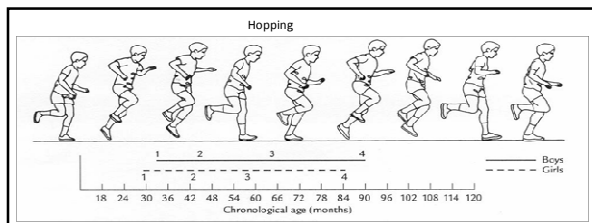
- **Mature:** Arms extend forward and upward upon takeoff, reaching full extension above the head. Hips and knees are extended fully. Takeoff is $< 45^\circ$. Upon landing, thighs are parallel to the surface. Center of gravity is behind base of support. Knees flex and arms thrust forward at contact in order to carry center of gravity beyond the feet.

Hopping

- A form of jumping
- One foot is used to project the body into space with landing on the same foot
- More difficult than the two-footed jump
- Performed better on preferred foot

Hopping

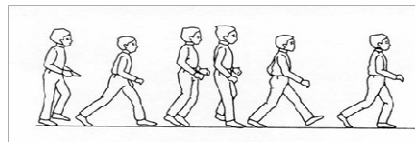
- Early: Nonsupport knee is flexed at 90° . Nonsupport thigh is parallel to surface. Body is in upright position with arms flexed at elbows. Hands are near shoulder. Force production is limited.



- Mature: Knee of the nonsupport leg is at 90° or less, but entire leg swings back and forth like a pendulum to aid in force production. The arms are carried close to the body, elbow at 90° . Nonsupport leg increases force production, so arm use decreases.

Gallop and Slide

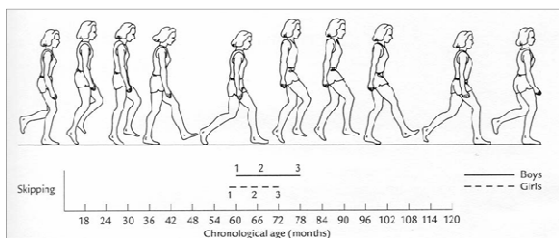
- gallop is exhibited first; A forward step followed by a leap onto the trailing foot; Same leg always leads.



- The slide is the same as a gallop, except instead of moving forward, it is performed in a sideward direction; This is more difficult because the child must face ahead while moving in a sideways direction.

Skip

- A more difficult motor pattern than gallop or slide
 - Forward step followed by a hop on the same foot; There is alternation of the leading leg; Balance may be difficult.



Fundamental manipulative Skill Development

Over-Arm Throwing

- Can be divided into 3 phases
 - Preparatory phase
 - All movements directed away from the intended line of projection
 - Execution phase
 - All movements performed in the direction of the throw
 - Follow-through
 - All movements following the release of the projectile
- One of the most complex fundamental movements.
- Key: Distance, Velocity, Accuracy

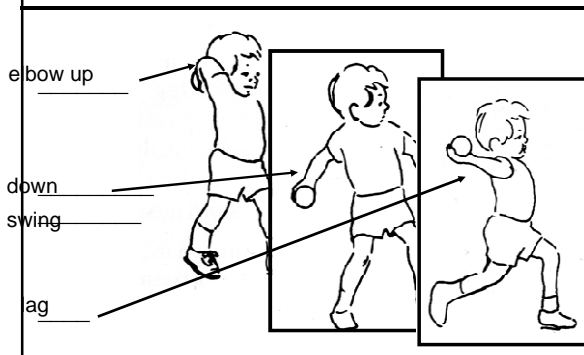
- help with cues

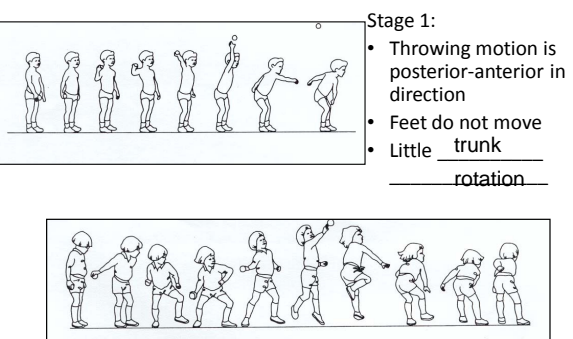
Over-Arm Throwing

There are five developmental stages of throwing progressing from an anterior-posterior plane to a horizontal plane. The base of support changes from a stationary to a shifting position.

Overarm Throw

Arm Analysis





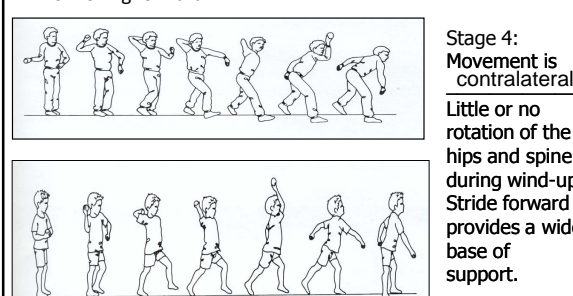
Stage 1:

- Throwing motion is posterior-anterior in direction
- Feet do not move
- Little trunk rotation

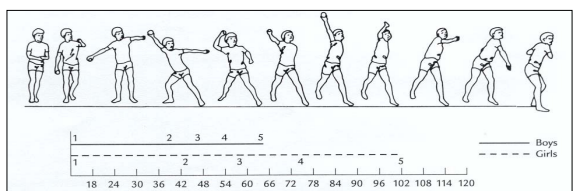
•Stage 2: More rotation of the body; Performer may step forward; Arm brought forward in transverse plane

Stage 3:

- Note the ipsilateral arm-leg action; The ball is placed into throwing position above the shoulder by a vertical and posterior motion of the arm at the time that the ipsilateral leg is moving forward.



Stage 4:
Movement is contralateral.
 Little or no rotation of the hips and spine during wind-up;
 Stride forward provides a wide base of support.



Stage 5: Mature throwing movement pattern

- Age at which 60 % of boys and girls are able to perform at a specific developmental level
- Seefeldt, Reuschlein, and Vogel (1972)
 - Note large gender differences in throwing development
 - lag in development for girls.

Accounting for Gender Differences in Over-arm Throwing

- The greatest gender differences for all fundamental skills is found with throwing
- Boys and men outperform girls and women at all ages.
- The best predictors of throwing development in girls is participation in sports and the presence of an older brother in the household
- The best predictors of throwing development in boys is a fathers sport involvement and father-son skill play

Factors that Influence Over-arm Throwing Performance

- Instruction
- Knowledge
- Instructional cues
- Ball size
- Angle of ball release

Instruction and Throwing

- Instruction significantly affects changes in throwing technique, but not greater horizontal ball velocities
- An “increased range of motion instruction” program can increase the stride length component of the over-arm throw
- A training program designed to improve throwing pattern can be effective in improving girls’ foot action and pelvic-spine rotation, but not arm action, throwing distance, or ball velocity.
- Role of critical instructional cues

Knowledge, Ball Size and Throwing

- Knowledge
 - Awkward throwers possess significantly less declarative knowledge than more talented throwers.
- Ball size
 - When ball diameter is scaled up, a transitional point is reached where performer resorts to a less mature throwing pattern in the backswing and forearm components
 - As diameter increases, there is a transition from one-handed grasping to two-handed grasping

Angle of Ball Release

- In those using an “arm-dominated” throwing pattern, the ball is released too early resulting in an upward trajectory (49 degrees)
 - May be linked to poor grasp, ball weight, and ball size
- A mature throwing pattern angle of release is 15 degrees

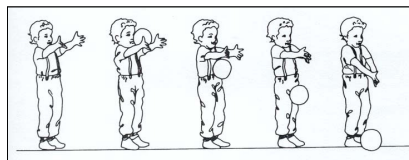
Developmental Aspects: Two-handed Catching

- This 6-year old child is showing fear in reaction to a thrown ball (from earlier failures?)
- Progression:
 - Trapping arms to body
 - No Cushion (Absorption)
 - Visually guided
 - Body movement to the implement
 - Use of hands
 - Fingers up or down depending on ball flight

Developmental Sequences for Two-Handed Catching

- Arms are directly in front with elbows extended; palms facing upward and inward
- Arms and hands attempt to secure the ball by holding it against the chest

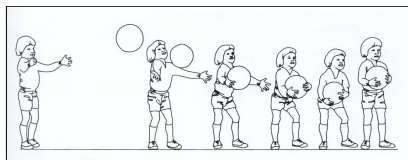
Stage 1



Developmental Sequences for Two-Handed Catching

- Elbows are slightly flexed
- Arms encircle the ball against the chest
- Arm action initiated before ball contact

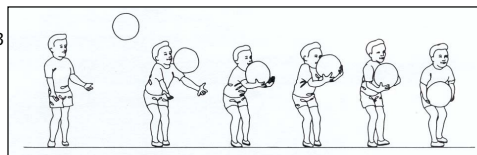
Stage 2



Developmental Sequences for Two-Handed Catching

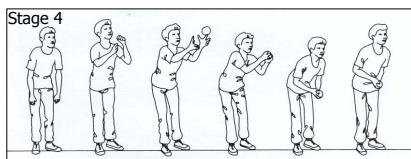
- Sub-stage 1: child uses chest as first contact point
- Sub-stage 2: child attempts to catch ball with hands

Stage 3



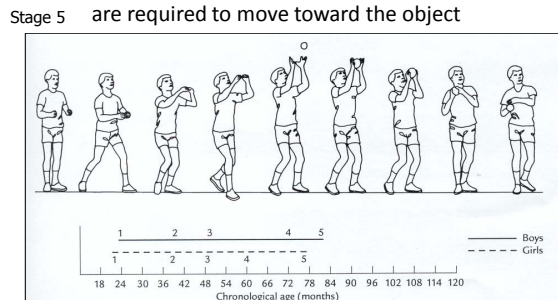
Developmental Sequences for Two-Handed Catching

- Stage 4: Child prepares to receive the ball by flexing the elbows and presenting the arms ahead of the frontal plane
- Ball is caught with the hands alone



Developmental Sequences for Two-Handed Catching

- Many children encounter difficulty when they are required to move toward the object



Factors That Influence Catching Performance

- Ball size
- Ball and background color
- Ball velocity
- Trajectory angle
- Vision and viewing time
- Instruction
- Knowledge and experience
- Catching on the run
- Catching with a glove

Ball Size and Color; Background Color

- _____ balls improve young children’s catching performance (product) but _____ balls are more conducive (foster improvements in) to successful catching (process): Isaacs, 1980.
- Blue and yellow balls are caught successfully more often than _____ balls
- Blue balls against white background elicit the highest success
- Child’s preferred color of ball results in greater catching success

Vision and Viewing Time

- _____ moving ball through space is preferred when working with inexperienced catchers. Try beach balls, whiffle balls, sponge balls...

Ball Velocity

- Important in predicting direction of projectile
- Catching performance decreases as ball velocity increases (25 ft/s to 33 ft/s)

Trajectory Angle

- Angle projection does _____ significantly affect a child’s catching ability.
- On average, _____ degree projection angle elicits success in catching (slightly lower in unskilled).

Knowledge and Experience

- Knowledge of catching can influence performance
- _____ knowledge (“how”) is higher in non-disabled children
- _____ knowledge (what”) does not differ significantly among the various groups
- “...such knowledge does not develop at the same rate and that catching experience may foster the acquisition of _____ knowledge, even though a deficit in _____ knowledge may be evident.”

Some Implications for Teaching Catching

- Don't _____ working memory (key cues; immediate specific constructive feedback...)
- Catching with a glove
 - A glove can alter the nature of errors typically observed in bare-handed catching
 - Glove catching is easier as ball moves toward a larger target and is caught over a larger surface area
 - Hand _____ is important
- Catching on the run
 - Since it is easier to catch a ball directed toward the child, teachers should use caution when pairing up inexperienced and experienced catchers

Inexperienced Striker

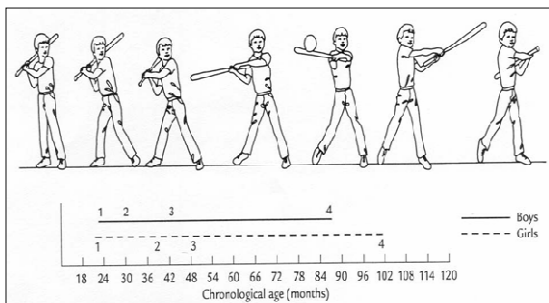
- No steps taken or step taken with homolateral leg
- up-down striking motion
- Little backswing
- No rotation of trunk or hip
- rigid arm; little wrist snap

Developmental Aspects of One and Two-Handed Striking

Experienced Striker

- Forward step with opposite foot taken
- Full backswing
- Swings implement horizontally
- Trunk and hip rotation
- Coordinated wrist snap

Mature Striking Pattern



Punting

From:

- stationary start
- Ball held in both hands and dropped or tossed forward
- Nonsupport leg is flexed
- Kicking force is more upward

To:

- Rapid approach with culminating leap
- Ball contacted at or below knee height
- Momentum of swinging leg carries the punter off ground.