Characteristics and Development of Complex Skills

Part II: Handwriting
Manipulation

- Once an object is grasped one either manipulate the object or release it.
  - If the object is to be manipulated stabilization of the fingertip forces must be sustained for a period of time to prevent slippage.
  - Manipulation is the movement of the object in space includes such things as tools, pencils, pens, and scissors; dressing, tying shoes, money handling, and cutting food.
Manipulation

Manipulation includes three categories of hand movements.

- Simple synergies
  * All hand movement in which the hand and thumb movement is similar such as grasping a ball.

- Reciprocal synergies
  * Involves the fingers and thumb working independently & different from each other such as rolling a pencil from the thumb to the forefinger.

- Sequential patterns
  * Systematic sequence of hand movement to perform a specific goal such as tying a knot.
Manipulation

• Strategies for developing manipulation skills
Manipulation Development

Treading/Braiding/Lacing
Sorting
Lummi Stick (Passing, Spinning, flipping, twirling)
Pick up sticks
Spooning
Tweezers pickup
Turn a lid of jar
Hand ball squeezers
Scissor, rock, paper
Finger aerobics (1-1, 2-2, 3-3, 4-4, 5-5, etc)
Keyboard activities (type words, numbers, etc.)
Handwriting

• In physical therapy to improve manipulation one requires the patient to grasp, lift, and release objects of different shapes, weights, and textures involving performing real tasks.

• In-hand manipulation is defined as the process of adjusting the object with one hand after grasping it (Exner, 1989).
  – In-hand manipulation includes
    • Translation (moving an object from fingers to the palm)
    • Shift (moving the object closer to one finger tips)
    • Rotation (rotating the object in the hand)

• In-hand manipulation is measures to determined if one has dexterity problems.
Handwriting

Specific type of manipulation that related to human development are:

- Prehension
- Handwriting
- Tapping
- Drawing
Handwriting

Studied through how one holds a writing implement, drawing to writing progression, and stages of writing.

It is assumed that one progress through specific stages in attaining handwriting.
Handwriting

• Difference control mechanism are involved in controlling:
  – What people write(e.g., letters, words)
  – How people write(e.g., writing surface)

• Writing involves both cognitive (retrieve letters, words, grammatical construction, spelling) and motor skills (holding the pen, size of letters).
HANDWRITING

• Based on motor equivalence, that is, one can adapt to specific demands of the writing context

• Motor equivalence provide for similarity in letters and stroke production across many contexts
Handwriting

In training or retraining handwriting one needs to examine the underlying components of the grasp and manipulation.
Handwriting

• Underlying components are
  – Wrist stabilization
  – In-hand manipulation
  – Hand arches
  – Development of power and skill sides of the hand
  – Training the fingertip force
  – Strength training of the intrinsic muscles of the hand
Handwriting

Well-designed handwriting programs enhance manuscript and cursive writing.

- Therapy programs will emphasize kinesthetic awareness through cursive writing.
- Multisensory experiences using assisted devices to facilitate writing.
Handwriting Development

Common Physical Problems

1. immature or incorrect grip (posture)
2. too much muscle tension
3. too much or too little wrist stability
4. wrist position too flexed or hyperextend
5. head titled too much to one side
6. paper not positioned correctly
7. writing above and below the line often to do with wrist position)
Handwriting

The mature grasp of the pencil or crayon is referred to as the dynamic tripod posture. One usually masters the dynamic tripod posture by the age of 7.

Children pass through predictable stages of handwriting techniques.

-The child starts out by holding the instrument with their whole hand and progress to a finger posture (proximodistal)
Handwriting

Major stages of handwriting technique
- Supinate grasp (four fingers and thumb wrapped around the instrument.
- Pronate grasp (palm-down hand position)
- Dynamic tripod posture (thumb, middle finger, and index finger)

Study with adults show that 88% use the tripod posture (Bergman, 1990).

Majority of children past 6 years of age used the tripod grip (Henderson & Schneck, 1990)
Handwriting Development

Supinate Grasp

Pronate Grasp

Figure 12-4 The supinate grasp, the first stage in holding a writing or drawing implement.

Figure 12-5 The pronate grasp: The hand is held with palm down.
Handwriting Development

Left Hand Grips
Handwriting Development

Right Hand Grips
Handwriting (6 year old child)
Handwriting (3 year old child)
Handwriting

Development of the ability to print recognizable letters occurs at 4 years of age but they are all over the page.

By 5 or 6 name printing in upper case is mastered.

By the 3rd grade children are printing in smaller upper case and name printing but not lower case.

By the 4th grade children lower case printing occurs but letters of t, f, and k are difficult (multiple stroke letters) and spacing of letters remain unmastered.
Handwriting Development

Spatial concepts

Speed Activities
Handwriting Development

Lower case lettering

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<th>Color these letters</th>
<th>h</th>
<th>h</th>
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<th>h</th>
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</thead>
<tbody>
<tr>
<td>Trace inside these letters</td>
<td>h</td>
<td>h</td>
<td>h</td>
<td>h</td>
</tr>
<tr>
<td>Trace along these letters</td>
<td>h</td>
<td>h</td>
<td>h</td>
<td>h</td>
</tr>
<tr>
<td>Trace along these letters</td>
<td>h</td>
<td>h</td>
<td>h</td>
<td>h</td>
</tr>
<tr>
<td>Write your own letter</td>
<td>h</td>
<td>h</td>
<td>h</td>
<td>h</td>
</tr>
</tbody>
</table>
Handwriting

Development of pencil manipulation is cross-cultural.

- Japanese and British children developed in similar fashion (Rosenbloom & Horton, 1971)
  * Stages were similar in attaining the tripod posture but Japanese children attained the tripod posture earlier due to eating with chop sticks.
Handwriting

1. Drawing always precedes writing letters.
2. Drawing ability is a function of the child’s mental age.
3. Reason for immature drawings by young children is because the brain is not fully developed.
4. One begins to draw around 15 to 20 months in form of scribbles with no apparent organization and become bolder as the child gains confidence.
Handwriting

Drawing is 4 step process (Kellogg, 1969):
- Scribbling stage
  - First step to hand-eye coordination
- Combine stage
  - Construction of basic diagrams and geometric figures
  - Gains understanding of how to create figures (stick figures)
- Aggregate stage
  - Combines 3 or more figures
- Pictorial stage
  - More refined and complex drawings includes depth
Drawing Development

Sequential Coloring

Channeling Activities
Drawing Development

Tracing Activities

Copying Activities
Finger Tapping

Repetitive task, that is, repeat the same movement over and over such as thumb and forefinger tap together as fast as possible.

Successive movements, that is, series of movements performed in rapid succession such as alternating thumb and forefinger.
Tapping

Tapping speed has been commonly examined and used to measure motor speed.

-e.g. effects of yoga on tapping speed.
Fine Motor Changes with Age

Handwriting and tapping in most individuals plateau fairly early in life.
- degeneration of neurons
- disease (arthritis & osteoporosis)
- loss of brain cells & cerebral blood flow

Biggest decline is in speed of movements.
Decline in fine motor skills of handwriting, prehension, drawing, and tapping is less in physically fit or exceptionally healthy individuals (Salthouse, 1985).