THE PROCESS CURRICULUM

Psychomotor Competence

Verticality

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DEFINITION

Verticality is the process of differentiating on the basis of proprioceptive cues (inner bodily sensation), the direction of gravity and integrating neuro-muscular operations with reference to this direction, so as to permit optimal body stability while providing the maximum potentialist for efficient movement under varying postural conditions.

DESCRIPTION

One of the major environmental constraints to which one must adjust is the force of gravity. Before he can walk or even sit up, the child must begin to orient himself to this force. The force of gravity pulls the mass of one's body toward the center of the earth and the vertical dimension (awareness of up and down), is derived from the perceived direction of gravity (this involves the kinesthetic mode only). When standing erect (or vertical), an imaginery line drawn from one's head, through one's feet to the center of the earth coincides with the line of gravitational force. Using this vertical line as an axis, the child becomes aware of three dimensions: up and down, right and left, forwards and backwards.

As the body moves and changes position, the direction of gravity through the body changes. For example, when one is standing erect, the direction of gravity is from back to front. As he makes these movements, the child learns that it is he that is moving, and not the environment around him thus acquiring a sense of the constancy of the vertical direction.

During the first months of life, the child's continual experimentation with body movements and positioning under the influence of gravity provide the requisite experiences for him to learn balance and posture. Ultimately, the child must learn how to coordinate his neuro-muscular activities with gravity if he is to move gracefully and freely around the environment. When stationary, this means that he must distribute his weight evenly around the imaginary vertical line which passes through him, no matter in what position he is. When moving, weight must be redistributed so that the proper degree and direction of disequilibrium is produced for efficient movement. If he leans too far to one side, or too far forward or backward, he will fall over. He must learn to tense certain muscles at the right time in order to maintain flexible posture. This muscular tension prevents a disproportionate amount of weight from being exerted on any one side of the center of gravity. In this way then, the child develops an axis, or point of origin, from which he can pivot and move.

THEORETICAL JUSTIFICATION: ANISA

Verticality is necessary for the development of the posturing mechanism which, in turn, is basic to all other movement patterns. "Posture has been defined as a positive neuro-muscular act in which a series of muscle groups is innervated in pattern so that the position of the body with reference to the center of gravity is maintained (Dus ser de Barenne, 1934)." As the child moves his body under the constraints of gravity, in the manner described above, neurological patterns gradually develop which make balance automatic. These patterns insure that no behavior will eventuate in action that would result in imbalance, thus protecting him from possible injury due to falling or loss of bodily control. Even if one wished to fall forward, flat on one's face, the posturing mechansim would make carrying out such and action almost imposssible. Clearly, a sense of the vertical direction of gravity must precede the development of neurological and muscular patterns which maintain the center of gravity during movement. When verticality is properly established, a child can go on to recognize "upper" as that which is nearer the head, and "lower" as that which is nearer the feet (when the body is in an upright position). At first, the child may have to reach up to touch the object. By looking at his arms and feeling his arms move, he will notice that his arms and, therefore, the object is nearer the head. Eventually, he will be able to dispense with immediate bodily reference and differentiate which objects are "higher" and which are "lower" simply by looking at them.

Once the child can classify external objects by the upper/lower criterion, he will soon be able to transfer (generalize), this knowledge to objects which are not clearly "near the head" or "near the feet". For example, apart from an internalized differentiation of up and down (derived from the direct bodily experience of distinguishing between up and down), there is no way to distinguish "b" and "p". Because most older children and adults have long since dispensed with any explicit reference to the motor base, they simply think of the line in "b" going up and the line in "p" going down. However, verticality (the differentiation and integration of neuro-muscular patterns with respect to gravity) is necessary in order to be able to distinguish certain letters from each other such as "b" and "p" and is, therefore, a prerequisite to learning to read.

DEVELOPMENTAL CONSIDERATIONS

During the first two months of life, muscular movement is almost entirely reflexive. The most important among these innate reflex patterns is the tonic-neck reflex (TNR). It is expressed as an "arm extension accompanied by a lateral turn of the head while in the supine position" (lying flat on back with front turning upward) (Barsch, p. 71). The TNR

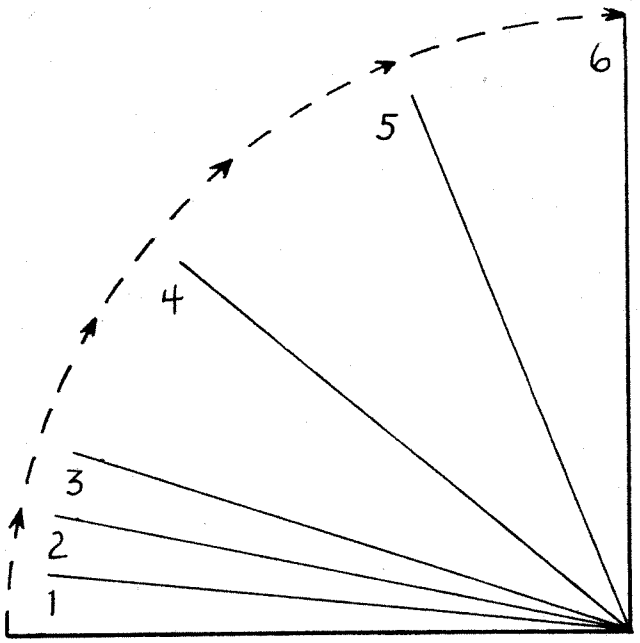
prepares the way for the development of verticality, laterality, and eventually balance and posture in an upright position primarily because it is the first step in liberating the organism from the mass (undifferentiated) response. The TNR gives the arm, leg and head practice in stretching and positioning so that when the voluntary patterns begin to emerge, the muscles will already have been rehearsed and no developmental time will have been wasted. (Barsch, p. 71).

One of the first voluntary movements of the infant is to roll over from a supine to a prone position (lying with front facing downward), a rotary motion across the vertical axis. The TNR prepares the way for this movement by stretching the neck muscles and by activating the laterals (side limbs) of the body. Barsch cites rolling-over as "an adventure on the vertical axis against minimal gravitational pull and serves to inagurate the construction of the vertical ordinate for the performer. (Thus), the horizontally oriented action of the TNR is intended to serve the vertical." (Ibid., p. 71). As the infant learns to roll over, the TNR declines as a reflex.

In the prone position the muscles of the neck must now undergo another exercise period in order to hold the head up against the pull of gravity. Soon his arms, already prepared for this movement by the TNR, tuck under his shoulders in order to raise the head even higher. Gradually, the head is further raised, by extending the arms, by raising the hips and crawling, by kneeling and finally, by standing. Each step of the way, the child must fight a battle against gravity, learning through trial and error the integrated patterns of muscular tension necessary for maintaining balance.

Cross-patterned crawling is a significant phase in the development of verticality because it requires the interweaving of both sides around the vertical axis. This, in turn, prepares the organism to distribute his weight evenly around the vertical axis in the standing position. In both cases, when the infant first starts crawling and when he first starts walking, the two sides work independently. He uses a homolateral (right arm and right leg) crawling pattern at first until he learns to integrate his movement by using the right arm and left leg together. Obviously, cross-patterned crawling involves the integration of lateral operations and hence includes more than simple verticality. Nevertheless, verticality is an important component. Likewise, when the infant first learns to walk, "he transfers weight fully from one side to the other in an exaggerated movement on a widespread pedal base." (Ibid., p. 74). Again, he must integrate his movements by thrusting his legs forward with a minimum of lateral drift and by maintaining the center of gravity along the vertical axis rather than shifting it from side to side.

The vertical axis is the first to develop. The horizontal and depth axes develop later. Only then can directionality, the assignment of



Schematic drawing of the dynamic arc of progression from prone to erect position. 1. Head elevation. 2. Shoulder and head elevation. 3. Crawling position. 4. Kneeling position with hand support. 5. Standing position with hand support. 6. Full vertical position without hand support. (Barsch, p. 78).

directional relationships to objects in the outer world, take place.

Barsch summarizes the developmental scheme which takes place within each stage as follows:

> The basic progression from mass preparatory action (undifferentiated) to monolateral function leading to the use of the two sides of an "either-or" basis, followed by the alternate use of sides as independent segments on a bilateral scheme and finally developing a motoric convergence on the midline in a crossed pattern represent a fundamental model for defining goals in the movement sequence for learners at all ages. (p. 79)

This general scheme will guide us in forming educational objectives.

Chaney and Kephart (1968, pp. 60-63) have listed ages at which some of these processes take place. (Only a portion of her chart is presented here).

1 Month	Reacts with mass motor activity to any stimulation.
2 Months	Can hold up head for several seconds.
3 Months	Head wobbles slightly if child is erect.
4 Months	Rotates head from side to side while lying on back. Can hold head steadily erect if supported in a sitting position.
5 Months	Can momentarily support large fraction of his weight in standing position. Can roll over by rotating upper part of the body, flexing hips, and throwing leg to same side. Rolls from his back to facedown position.
6 Months	Holds head erect, and can rotate easily. Supports self on outstretched arms.
7 Months	Momentarily can hold trunk erect in a sitting position. Assumes crawl position with weight supported on one or both arms.
8 Months	Can support entire body weight on feet for short intervals.
9 Months	Can hold trunk erect indefinitely in sitting position. Can lean forward and regain sitting position. Can stand on toes. Assumes creeping position on hands and knees.
10 Months	Can pull self to knees and can stand with support.
11 Months	Can go from sitting to face-down to sitting position.
12 Months	Can lower self from standing to sitting by holding onto crib rails, chair, or other support. Cruises or walks about using support.

13 Months	Can creep on hands and knees.
15 Months	Can stand quite independently.
18 Months	Good sitting balance.
20 Months	Stands on one foot with help.
21 Months	Begins to run. Can walk up flights of three steps alone.

EDUCATIONAL OBJECTIVES

The following objective is stated generally. Specific objectives will accompany each prototypical experience.

To differentiate on the basis of kinesthetic and vestibular cues, the direction of gravity and integrate neuro-muscular operations with reference to this direction so as to permit optimal bodily stability and provide maximum potentiality for efficient voluntary movement under varying postural conditions.

PROTOTYPICAL LEARNING EXPERIENCES

I. Crossed Patterned Crawling

Each one of the movement patterns--rolling, crawling, walking--contributes to the establishment of vertical alignment. If a child inadequately completes one of these stages, or skips it entirely, he may have trouble later on. If the child has difficulty walking smoothly and independently by the time he is three years old, it may be wise to take him back to the crawling practice.

A. Objective: To crawl 15 feet using a crossed patterned motion--right arm and left leg, then left arm and right leg.

B. Procedure: The sequence of crawling is as follows--homologous pattern where the body moves as a whole unit; homolateral pattern, the right leg and the right arm move together. The teacher should make sure that the child has mastered the homolateral pattern before encouraging him to go on to the cross-patterned crawling.

Often it is simply a matter of explaining to the child what he should do. Other children require personal demonstration by the teacher or manipulation of the limbs of the child by the teacher.

The synchronization of arms and legs is a problem for some children. It may help to use a sharp accented oral count, a tom-tom, drum or tambourine to establish the proper order. Elastic bands connecting the arm and corresponding leg help to remind the child which leg to move. (This applies to both homolateral and cross-patterned crawling.)

After synchronization is achieved, the next problem is usually alignment. Learning to align the body during crawling can be done in several ways: 1) Ask the child to crawl near a wall. Sometimes the wall should be at his right side, sometimes at his left. 2) Ask the child to balance a bean bag or book on his head to increase his awareness of the positioning of the head. 3) Choose a target toward which the child should direct himself. 4) Attach weights to the wrists and ankles to heighten awareness of position. 5) Have the child crawl on a narrow (12 inch) inclining or declining surface.

C. Evaluation: Choose a target at one end of the room. Ask the child to start at the other end of the room and crawl toward it. He should be able to crawl in a straight line directly toward the target. His right arm amd left leg should move at the same time.

II. Jumping

A. Objective: To identify the direction of, and to understand the constancy of the force of gravity well enough to jump from various heights.

B. Environment: Provide various equipment for jumping blocks of various heights, jump rope, objects to jump over.

C. Procedure: Instruct the child in the following activities, making sure he has mastered one before going on to the next.

Ages 2 - 3

1) Put blocks of various heights on the floor--three inches, six inches, one foot, etc. Ask the child to stand on the shortest block. Then ask him to jump off landing on two feet. If he does not fall and he feels comfortable, have him go on to the next block.

Ages 3 - 5:

2) Ask the child to jump up and down in the air. Next ask him to turn halfway around in the air. Ask him to turn all the way around. Play some music and have the children jump to the music.

Ages 3 - 5: 3) Ask the child to hop on one foot then on the other foot. Ask him to hop forwards and backwards. Draw a line, first forwards, then backwards.

Ages 3 - 5: 4) Ask the child to jump over a small object on the floor (such as the blocks used in 1. above). Put a slightly larger object on the floor and ask him to jump over it.

Ages 5 - 8: 5) Teach the child to jump rope. First ask him to jump up and down to an even beat. (You may want to clap your hands evenly.) Have him watch some other children jumping rope. Ask two other children to turn the rope slowly. Have him try to turn the rope himself.

D. Evaluation: In jumping the child should be able to land on two feet. He should be able to execute all of these jumping activities without falling and without fear of falling.

III. Walking Board or Balance Beam

A. Objective: To walk in a straight line on a balance beam.

B. Environment: Set up a balance beam: a ten foot 2" X 4" beam and two brackets notched to allow either face (2 inch or 4 inch) to provide a walking surface approximately four inches off the ground. For the youngest children, tape together some 8" X 10" construction paper to make a roadway.

C. Ask the youngest children to walk along the paper roadway. This will encourage directed walking. The child's hand may be held if necessary. When the child feels he is ready he should be encouraged to walk along the 4" surface, then the 2" surface. Ask him to walk forward, backward, and sideways. After the child becomes very proficient at this he should learn to turn on the balance beam and come back. The teacher should help only if necessary. (Other exercises can be found in Chaney.)

IV. Trampoline

A. Objective: To jump up and down on the trampoline without losing balance. To coordinate the muscles around the center of gravity in mid-air.

B. Environment: Buy or construct a trampoline. It is made of a metal frame within which a heavy canvas is stretched by means of springs.

The trampoline allows the child to counteract the force of gravity. Be sure to have several children standing around the trampoline to prevent anyone from falling off.

C. Procedure: Have the child walk around on the tramopline to get used to it. Next have him stand in the middle and jump up and down. His feet should be about shoulder width apart. His legs should be straight as he rises; his knees should be slightly bent when he hits the canvas again. He should try to stay in the center of the canvas. You may want to hold the child's hand at first. This will give him a clue to his center of gravity. When the child can bounce easily for a series of jumps without support ask him to try the following activities. Make sure he is comfortable before going on to the next one.

1) Bounce on one foot only (try both right alone and left alone.)

2) Alternate feet (jump once on left foot, once on right foot, etc.)

3) Try more complicated patterns (twice on left foot, twice on right, etc.; or twice on left foot, once on right, etc.)

4) Turn in the air

5) Land in sitting position with legs fully extended, return to sitting position (seat drop).

6) Land in kneeling position, return to standing position (knee drop).

D. Evaluation: The child should be able to perform the activities without falling. Make sure he is relaxed.

V. Bilateral Vertical Lines (ages 3 - 6)

A. Objective: To develop the visual awareness of verticality.

B. Procedure: Give the children the following instructions: (from Getman, pp. 52-53)

1. Stand facing the chalkboard with feet flat on the floor.

2. Touch the board with your nose.

3. Draw an "X" on the spot where your nose touched the board.

4. Pick up a piece of chalk in each hand.

5. Looking at the "X", place both pieces of chalk on the board in front of your shoulders, as high as your forehead.

6. Draw a line downward until it is level with your chest.

7. Leave your chalk on the board and draw back up the same line.

8. Now draw five more lines in a row on either side of the "X". It will look like a row of fence posts.

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C. Evaluation: The lines should be straight up and down. The lines should all be the same length. The lines should be evenly spaced.

VI. Jumping

Arrangement of Environment

A. Presentation to three children at any one time, ages 3 to 7.

B. Outside on the grass.

C. Presentation to take 2 - 3 minutes; children's experience to take 10 - 15 minutes.

D. Other outside activities which children can do with little supervision (with decisions on A, B, and C on each).

Guided Interaction

A. Six large hollow blocks of various sizes, set up in a line with three feet between each block.

B. Demonstrate scenario.

1) Invite the children to do the exercise, showing them the hollow block you have placed for jumping.

2) Step and stand firmly on the smallest block; flex your knees slightly; jump onto the grass.

3) Invite children to imitate you one at a time.

C. Talk about "jumping off the block"; doing it "one at a time".

Choose children by calling their names in the order you wish them to jump. Invite them to "go on to the next block and jump". "Try jumping off sideways, starting with the smallest block".

Rehearsal

Experience

Critique

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