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ABSTRACT

Presented is a discussion of the use of motor activity learning which may be used to foster the development of science concepts by mentally handicapped children. For the purposes of his presentation, the author uses "mentally handicapped" to designate those children who fit into any of the categories of those who are mentally retarded, have learning disabilities, or are handicapped by factors other than intellectual subnormality and thus fail to keep pace with their peers in academic achievement. Motor activity refers to things that children do actively in a pleasurable situation in order to learn. The author suggests that science experiences, particularly those of the physical sciences, can be presented through physical education activities and provides eight concepts to illustrate this point. Drawing on available research data, the author presents four generalizations which he feels support using motor activity learning to develop science concepts. (PEB)

THE USE OF MOTOR ACTIVITY IN THE DEVELOPMENT OF SCIENCE CONCEPTS WITH MENTALLY HANDICAPPED CHILDREN*

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It appears essential at the outset of this report to establish some sort of operational definition or description of the term "mentally handicapped." Are we dealing with mental retardation which encompasses all degrees of mental deficit? Or, are we dealing with learning disability due to impairment of expressive, receptive, or integrative functions? Or, are we dealing with depressed potential which recognizes that factors other than intellectual subnormality affects achievement in the classroom?

For purposes of this report I am going to take a position of broad generalization and consider the mentally handicapped as those children who fit into any of the preceding categories, and for these or other reasons fail to keep pace with their peers in academic achievement.

In providing appropriate learning experiences for the type of children we are dealing with in this discussion, it is essential to help them be successful by structuring activities to reflect the best principles of learning. A list of such principles which seems useful for our purpose is one suggested by Samuel Kirk in his book, Educating Exceptional Children. (13)

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I will state each principle and indicate the implications for learning through motor activity.

1. Progress is from the known to the unknown, using concrete materials to foster understanding of more abstract facts.

   Implication: Use of motor activity helps children act out and see and feel the concepts being developed.

2. The child is helped to transfer known abilities from one situation to another, rather than being expected to make generalizations spontaneously.

   Implication: Movement-oriented experiences enable children to work out the relationship of one situation with another and to make appropriate transfer of skills and generalizations easily.

3. The teacher may use many repetitions in a variety of experiences.

   Implication: Motor activities such as active games provide a pleasurable, highly motivating means for necessary repetition.

4. Learning is stimulated through exciting situations.

   Implication: Personal involvement, high interest, and motivation are concomitant with learning through motor activity.

5. Inhibitions are avoided by presenting one idea at a time and presenting learning situations by sequential steps.

   Implication: The structure of a motor activity such as an active game in itself implies logical ordering of ideas that are dramatized through physical movement.

6. Learning is reinforced through using a variety of sensory medalities--

visual, vocal, auditor, kinesthetic.

Implication: Motor learning heightens the learning act when integrated with verbal learning experiences.

Now, let us turn more specifically to the topic at hand. The idea of motor activity learning is not new. In fact, it's origin can be traced to the Froebelian kindergarten around 1830. Froebel's thoughts and ideas stressed the natural and spontaneous growth of children through play and action. The application of motor activity was a basic principle underlying his work, and was based on the theory that children learn and acquire information, understanding, and skills through motor activities in which they are naturally interested.

In the present context motor activity learning refers to things that children do actively in a pleasurable situation in order to learn. This might well suggest to physical educators and/or classroom teachers who have the responsibility for teaching physical education that motor learning activities can be derived from basic physical education curriculum content found in such broad categories as game activities, rhythmic activities, and self-testing activities. Thus, motor activity learning might also be referred to as the physical education learning medium.

Science and Physical Education

The opportunities for science experiences through physical education are so numerous that it would, perhaps, be difficult to visualize an activity which is not related to science in some way. This is particularly true of physical science principles, since practically all voluntary body movements are based in some way upon one or more principles of physical science. The following generalized list, by no means complete, is suggestive of some of the possible ways in which opportunities for science experiences might be utilized through physical education. (1)

1. The principle of equilibrium or state of balance is one that is involved in many physical education activities. This is particularly true of stunt activities in which balance is so important to proficient performance.
2. Motion is the basis for almost all physical education activities. Consequently, there is the opportunity to relate the laws of motion in an elementary way to physical education movement experiences.
3. Children may perhaps understand better the application of force when it is thought of in terms of hitting a ball with a bat or in tussling with an opponent in a combative stunt.
4. Friction may be better understood by the use of a rubber-soled shoe on a hard-surfaced playing area.
5. Throwing or batting a ball against the wind can show how air friction reduces the speed of flying objects.
6. Accompaniment for rhythmic activities, such as the tom-tom, piano and records, helps children learn that sounds differ from one another in pitch, volume and quality.
7. The fact that the force of gravitation tends to pull heavier-than-air objects earthward may be better understood when the child finds that he must aim above a target.

8. Ball bouncing presents a desirable opportunity for a better understanding of air pressure.

In recent years, our understanding of the relationship between science and physical education has become more pronounced. In this regard, I should identify at this point two specific branches of physical education that are not only related to child learning in the area of science, but in the other curriculum areas as well. I will arbitrarily call those branches compensatory physical education and cognitive physical education.

Compensatory physical education is essentially concerned with neuromotor perceptual training. It involves the correction, or at least some degree of improvement, in certain motor deficiencies--especially those associated with fine coordinations. An example of the need for this type of training is the child who has a reading problem involving coding or decoding. What some specialists have identified as a "perceptual-motor-deficit" syndrome is said to exist in such cases. Programs in compensatory physical education can be established to correct or improve fine motor control problems through a carefully developed sequence of motor competencies following a definite hierarchy of development.

This paper is concerned with the second of the two branches mentioned above. Cognitive physical education is an approach that helps children develop science concepts through the physical education learning medium.

This aspect of motor activity learning is based essentially on the theory that children--being predominantly movement oriented--will learn better when what we will arbitrarily call "academic learning" takes place through pleasurable physical activity; that is, when the motor component operates at a maximal level in skill and concept development in school subject areas essentially oriented to so-called "verbal" learning. This is not to say that "motor" and "verbal" learning are two mutually exclusive kinds of learning, although it has been suggested that in verbal learning which involves almost complete abstract symbolic manipulations there may be among others, such motor components as tension, subvocal speech, and physiological changes in metabolism which operate at a minimal level. It is also recognized that in physical education activities, verbal learning is evident, although perhaps at a minimal level. For example, in teaching a physical education activity there is a certain amount of verbalization in developing a kinesthetic concept of the particular activity that is being taught.

The way in which motor activity learning is used to teach science involves the selection of a physical education activity in which a science concept is inherent. The activity is taught to the children and used as a learning activity for the development of a science concept. An attempt is made to arrange an active learning situation so that a concept is being acted out, practiced or rehearsed in the course of participating in the physical education activity. In this procedure it is theorized that the concept is removed from the realm of the abstract and becomes a part of the child's physical reality. Let us consider an example. This example involves the concept: Electricity travels along a pathway and needs a complete circuit over which to travel. The activity to develop the concept is Straddle Ball Roll. The group is divided into four or more smaller groups. The children of each group stand one behind the other in single file. All are in stride position, with feet far enough apart so that a ball can be rolled between the legs of the players. The first person in each file holds a rubber playground ball. At a signal, the person in front of each file starts the activity by attempting to roll the ball between the legs of all the children in his file. The team that gets the ball to the last member of the file first in the manner described, scores a point. The last player goes to the head of the file and this procedure is continued, with a point scored each time for the team that gets the ball back to the last player first. After every player has had the opportunity to roll the ball back, the team which has scored the most points is declared the winner. An application of this would be as follows: The first player at the head of each file becomes the electric switch which opens and shuts the circuit. The ball is the electric current. As the ball rolls between the children's legs, it moves right through if all legs are in proper lineup. When a leg is not in the proper stride, the path of the ball is impeded and the ball rolls out. The games has to be stopped until the ball is recovered and the correction made in the position of the leg. The circuit (that is, the child's leg) has to be repaired before the flow of electricity (which is the path of the ball) can be resumed.

Generalizations of the Research Findings

Over the years we have conducted a number of controlled studies in the area of reading (2,3,4,5) and mathematics (6,7,8) as well as in the area of science. (9,10,11,12,14) Notwithstanding the fact that our work has been much more exploratory than definitive, we do have some objective data which tend to support a long-held hypothetical postulation. Because of this we feel that we can set forth some generalized assumptions along with some reasonable speculations with a greater degree of confidence.

Obviously, the available data are not extensive enough to carve out a clear cut profile with regard to learning through motor activity. However, they are suggestive enough to give rise to some interesting generalizations which may be briefly summarized as follows:

1. In general, children tend to learn certain academic skills and concepts better through the motor activity medium than through many of the traditional media in such subject areas as reading and language, science and mathematics.
2. This approach while favorable for both boys and girls, appears to be more favorable for boys.
3. It appears to be more favorable for children with below normal intelligence. Herein lies its importance as a learning medium for mentally handicapped children.
4. For children with high levels of intelligence it may be possible to introduce more advanced academic skills and concepts at an earlier age through the motor activity learning medium.

Now, before closing our discussion, I should perhaps call to your attention what some persons might consider as possible limitations of the use of Motor Activity Learning. Incidentally, it is my impression that the suggested limitations of it are likely to center around inertia and tradition rather than the validity of the medium itself. In any event, some individuals feel that children will not take this approach seriously enough and thus will not concentrate on the skill or concept being taught. For the most part, our experience has been quite the contrary especially with slower learning children. In another sense, some fear that this medium may be too attractive to children. For example, in many of our experiments some children has asked, "Why don't we learn it this way all the time?"

I am not entirely sure what the future holds for this particular medium of learning. I do feel that it has infinite research possibilities. In any event I feel pretty well assured that more serious attention is presently being paid to the motor activity learning medium. I have discussed it with some of the leading neurophysiologists, learning theorists, child development specialists and others. There is pretty general agreement among specialists in the various disciplines that the premise is very sound from all standpoints: philosophical, physiological, and psychological.

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