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A Study of Four- to Six-Year-Old German Children

Liselott Diem

Investigations about the swimming behavior of human infants were started in 1968 at Sporthochschule Köln (Hofman, 1980).¹ The research referred to the relationship between physical activities and developmental progress, which was first described in the studies of McGraw.² Unlike the earlier studies, Diem, Lehr, and others³ considered not only biological functions, but tested the influence of swimming and other physical activities on designated personal/social development characteristics of young children.

Besides controlling the effect of this early stimulation on the swimming behavior of infants, the question as to how this would influence the personality development of the children was investigated. Many parents believed that the child with early perceptual training exhibited more intelligent behavior than another child of the same family with no stimulation.

This question has been systematically studied since 1971. In an experimental design, children who were exposed to swimming after their second month of life were compared with others who were stimulated only from their twenty-eighth month of life. The investigation covered data collection about the acquisition of swimming, general motor performance, psychological development, and the behavior of the parents when playing in water with their babies.

In the beginning of one investigation, only the researchers' subjective observations and those of the children's parents were noted. They revealed that "swimming babies"—in contrast to their peer group—were better adapted, had a stronger self-security, and were more independent. Additionally, they showed better performance ability in



Photo: Liselott Diem

new situations. Observations made in gymnastic classes where swimmers as well as nonswimmers participated led to the following hypothesis: Swimmers are self-willed and more independent in making decisions. They move spontaneously, are unafraid and self-secure, and demonstrate generally greater motor activity. New situations are handled faster and more independently, and swimmers are more physically fit than nonswimmers.

This article is based on a study that considered whether and how effects of early motor stimulation influence the development of the four- to six-year-old child.

A longitudinal study was clearly necessary to cope with the multidimensionality of child development; in short, the developmental processes and the possibly intervening variables would have to be controlled over a period of years. In March, 1975, testing of questionnaires and procedural methods was begun.

Sampling

After the pretest, 300 parents living in the district of Cologne, West Germany, were contacted; 80% of them showed an interest in participating in the investigation. A questionnaire was sent to them which served the match-to-sample arrangement. This procedure ascertained the comparability of the samples with regard to sex, birth, order in family, age, size of the household, and financial situation. From the 240 questionnaires returned, 70 "experimental twins" (children matching the above criteria, but belonging to different samples) could be chosen, so that the total number of 189 (age 2.3 to 4.0 years; 87 boys and 102 girls) emerged for investigation.

Timing

The original number of 189 children decreased to 165 (a certain fading of subjects is not unusual in internationally known longitudinal studies). Therefore,

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Not only did parents have opportunities to participate in baby swim sessions, they were included in the research method so that mother and child interactions could be observed and analyzed.

this report is based on the results of 495 single tests of 4 hours each, administered to the 165 children and their mothers three times each between November, 1975, and June, 1977.

During the two years of observation, the motor programs were applied in one-hour weekly training. Children were accompanied either by their mother or their father. Every half-year controlled observation and measures were taken from each child so that trend curves of the motor abilities could be recorded.

Training Program for Partial Samples

The most important motor activity was swimming. Water movements offer the child many possibilities for movement and play. A motor learning program supplemented the swimming stimulus. This program did not consist of programmed instruction, but was designed to provide the child with opportunities for random movement throughout various movement planes. Various forms of motor stimulation, corresponding to the hypothesis, were administered to the comparable match groups. These samples were:

Partial Sample 1 contained children who had participated in the baby swimming program from the third month of life.

Partial Sample 2 was comprised of these same early swimmers who received the additional stimulus of a motor learning program from the age of 3.6 years.

Partial Sample 3 consisted of children who began swimming at 2.4 years.

Partial Sample 4 was comprised of the Sample 2 group—early swimmers

who also received the stimulus of an additional motor learning program. (Samples 2 and 4 are not included in the final analysis for methodological reasons.)

Partial Sample 5 included children who were given gymnastic training (on and off apparatus) from 3.6 years.

Partial Sample 6, very carefully selected, served as the control group. This group received no stimulation.

The motor development level of each group was measured at the beginning of the study. This was done by applying tasks like balancing, running, long jumping, trampoline jumping, etc.

In addition to development tests, the program for investigation contained ability and performance tests, methods for controlling motor abilities, methods for testing social behavior and diagnosing personality, and concentrated interviews with the mother about her child's former course of development. Parents, too, were included in the investigations. Inquiries about the style of child rearing were administered to both fathers and mothers. Additionally, mothers were asked about their education goals, educational role expectations, and role satisfaction. Mother-child interaction was observed and analyzed in particular situations. Within methodological limitations, these investigations were carried through all three measurement times in the same manner by the same experimenters.

The repeated testing provided extensive data which was methodically analyzed and statistically processed. More than 70 videotapes were taken which allowed independent judges to observe the behavior of the children after the psychological and motor

tests. The investigation provided researchers with a considerable amount of data. The following brief account deals with the most important developmental processes in the *social, personality, ability, and performance* areas.

The major findings of this research were: the psychophysical development of motor-stimulated children was often organized differently (mostly in an accelerated form) when compared to the psychophysical development of the nonstimulated children. This finding was unexpected in that the psychological development theory hardly concerned itself with differentiated courses of development in certain phases of the child's age. Rather, theorists concurred that all persons from the early to the older adult years experience phases of partially accelerated, partially decelerated continuity of development. Corresponding to the view of modern development psychologists, individuals differ little in the course of these developmental phases.

Personal/Social Development

When compared with the nonstimulated children, motor stimulated children showed a greater readiness for social contact. They integrated more easily into the peer group, paid visits to other children in the neighborhood more often, preferred to play outside the house, and were able to react more coolly to disappointments inflicted on them by their peers. Children who participated in the baby swimming in their first year of life exhibited more highly developed social behavior when they were first tested at four years of age.

Personality. The development of the child's personality was considered in terms of *independence* (versus dependence, anxiety), *performance motivation* as well as *differentiation, adaptation to the presented tasks, incitation* (by the task situation), and *drive*. While all members of the group demonstrated a progressive development toward independence and self-assurance, even stronger development was observed in children who experienced an additional motor stimulation. The highest scores from the original tests were also produced by the early swimmers.

The motor stimulated children demonstrated better ability to cope with new and strange situations without the obvious effective (anxious) component of children in the control

group. The data shows the same trend relative to behavioral self-control, differentiating ability, ability to adapt to the task situation, and in a weaker form, for incitation and drive.

Motivation performance also increased continuously in all children; however, the effects could be recognized primarily in Samples 3 and 5. The early swimmers (Partial Sample 1) demonstrated a tendency to increase their motivation performance over the entire investigation period.

All results stress that stimulating conditions as applied to Samples 3 and 1 (promotion by swimming classes and, to a lesser extent, by the motor learning program from 3.6 years), seem to have positive effects on the personality items previously cited.

The performance increase demonstrated by the motor trained samples exceeded that of the control group. The *reaction velocity* (speed of reaction) increased significantly in all children during the observational period. Motor training through swimming and/or the motor learning program resulted in additional increased reaction velocity.

Using absolute measures, the development of concentration ability among children who had undergone training and gymnastic classes, surpassed the increase in concentration ability of the control group children. Swimming or gymnastics seemed also to positively influence concentration test accuracy.

Early swimmers in nearly all subtests of the administered intelligence tests (Wechsler Preschool, Primary Scale of Intelligence—WPPSI, and Hamburg Wechsler Intelligence Test for Children—HAWIK) showed higher intelligence scores at the beginning of the two-year research period than did the children who entered one program when they were older and were promoted, or from the control group.

Sample 1 (early swimmers) again exceeded in the third trial of intellectual ability, though not in a statistically significant way. Without exception, children of motor-trained groups 3 and 5 scored significantly higher on improvements in intelligence performance. Expressed in absolute scores, the rate of increase of most of the subtests surpassed the analogous scores of the control group (Partial Sample 6.)

In *motor abilities and skills*, the

motor stimulated children (in particular Sample 1, promotion by early swimming) displayed outstanding differences in movement quality, movement accuracy, and balancing and reaction ability when compared with the children of the control group. It can be generalized, then, that the early swimming and to a lesser degree the motor learning program, resulted in qualitative improvements in these areas.

The study showed that early motor stimulation affected the entire development of the child aged four to six years. However, one must question the extent to which these effects can be interpreted solely on the basis of cause and effect.

It can be concluded that as a functional area motor training in early childhood permits the child to make best use of or more fully experience his/her individual competency. Such activities support the development of *autonomy*, a "developmental task" whose solution Erickson⁴ placed in the period between two and four years.

At the same time, body movement seemed to provoke the interaction between children and parents. This allowed parents to give the child more autonomy and to induce the de-

velopment of autonomy through direct motor action, social contacts with peers, coping with anxiety, and the like. At the same time, the child begins to attribute his/her growing autonomy to personal efforts and efficiency in mastering new tasks.

In general, motor promotion sets a framework for the establishment of activities by the parents which meet the infant's striving for autonomy. These activities allow the child to attribute increased success to his/her own efficiency and at the same time provide sufficient reinforcement and reward to parents and children alike.

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