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Parent Perception of Child's Developmental and Coordination Skills Related to Participation in the Gymnastics through Early Movement Program

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Final DNP Project Report

Parent Perception of Child's Developmental and Coordination Skills Related to Participation in
the Gymnastics through Early Movement Program

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Abstract

This study aims to evaluate the effectiveness of the Gymnastics through Early Movement program in increasing motor ability in children with motor developmental delay or coordination deficits through the perception of the parent. The Gymnastics through Early Movement program is a therapeutic gymnastics program developed by a pediatric nurse and professional member of United States of America Gymnastics. The program was designed specifically for pre-school aged children who experience motor challenges. Over the course of six weeks, each 45-minute lesson included activities and obstacles focusing on fundamental preschool gymnastics skills to develop strength, coordination, and flexibility. The American Academy of Pediatrics supports child participation in sports to increase development in all areas. Gymnastics is one of the most comprehensive sports available to children, incorporating strength, flexibility, and balance to develop a range of motor and coordination skills as well as improving body awareness and posture. Evidence has shown participation in early intervention programs that address mental or neuromuscular and movement-related functions result in significant improvement (Park, Maitra, Achon, Loyola, Rincon, 2014). The Developmental Coordination Disorder Questionnaire (DCDQ) was used to evaluate the change in parent perception of their children's motor and coordination skills after participating in the Gymnastics through Early Movement program. Results demonstrated positive findings in the areas of general coordination and motor control. Specific improvements were found in post-test scores regarding endurance, posture, and agility. The fine motor category showed increased mean scores from 8 to 8.3. Mean scores for coordination increased from 12.6 to 14.3 and total score means increased from 37 to 41. All participants reported the Gymnastics through Early Movement program as valuable and fun for their children.

Parent Perception of Child's Developmental and Coordination Skills Related to Participation in the Gymnastics through Early Movement Program

Introduction

In the United States one in six, or approximately 15% of children ages 3-17 years-old have one or more developmental disabilities. Developmental delay is a significant delay of at least two standard deviations below the age-appropriate norm in at least one category. The DSM-V defines Developmental Coordination Disorder as a significant impairment in the development of motor coordination which markedly interferes with academic achievement or activities of daily living (American Psychiatric Association, 2013). Developmental Coordination Disorder (DCD) is a common developmental disorder among children and may manifest by marked delays in achieving motor milestones, dropping items, clumsiness, poor performance in sports or poor handwriting in school-aged children (Wilson et al. 2009).

To address motor developmental delay and DCD, the Infants and Toddlers with Disabilities Program (Part C) of the Individuals with Disabilities Education Act (IDEA) was created in 1986. The goal of this legislation was to enhance the development of infants and toddlers with disabilities, minimize potential developmental delay, and reduce educational costs to society by minimizing the need for special education services as children with disabilities reach school age (IDEA, 2004). First Steps is the statewide early intervention system in Kentucky providing services to children 0-3 years-old with developmental disabilities. First Steps offers comprehensive services through a variety of community agencies and is administered by the Department for Public Health. Those who graduate from First Steps may go on to enroll in Kentucky's Head Start or Early Head Start programs. However, these programs are offered only during traditional school sessions creating a gap in service during the summer.

Additionally, children who improve through First Steps may no longer meet criteria for Head Start benefits even though they may not have reached the same motor functioning as their peers.

Evidence supports high quality early intervention programs for vulnerable children to reduce the incidence of future problems in their learning, behavior, and health status. These services can change a child's developmental trajectory and improve outcomes for children, families, and communities. Intervention has been found to be more effective and less costly when it is provided earlier in life when the developing brain is most capable of change (Center on the Developing Child at Harvard University, 2008; 2010). Furthermore, participation in early intervention programs that address mental or neuromuscular and movement-related functions result in significant improvement (Park, Maitra, Achon, Loyola, Rincon, 2014).

The American Academy of Pediatrics supports child participation in sports to increase activity and develop socially and physically. Gymnastics is one of the most comprehensive sports available to children, incorporating strength, flexibility, and balance to develop a range of motor and coordination skills as well as improved body awareness and posture. There is limited data on the use of gymnastics and its effect on motor coordination skills in children with Developmental Coordination Disorder or developmental delay. The first published report of an artistic gymnastics program adapted for children with cerebral palsy found that six weeks of gymnastics training led to improvements of 10% or more in muscle strength, neuromuscular activation, range of motion, functional motor performance, and balance not seen after the control period. Furthermore, quality functional motor scores showed an average of 15% improvement in basic gross motor abilities from pre- to post-intervention. In this study, parents reported their children could apply these techniques to everyday motor tasks (Cook et al, 2015). There is

evidence from multiple sources to suggest gymnastics-based programs may be effective as an early childhood intervention to decrease motor development and coordination deficits.

The aim of this project is to evaluate parent perception of child's change in developmental and coordination skills related to participation in the Gymnastics through Early Movement program.

The Gymnastics through Early Movement Program

Gymnastics through Early Movement is a therapeutic preschool gymnastics program offered to early school-aged children whose parents perceive a motor skills or coordination deficit compared to peers. It is an early childhood intervention service for motor and coordination development offered free of charge in a non-clinical setting at Kentucky Gymnastics Academy, a 14,000 square foot gymnastics facility in Louisville, Kentucky. The program was developed in 2017 by a pediatric nurse practitioner student with experience in neurology and a professional member of USA Gymnastics with more than 25 years' experience as a high-level competitive gymnast and instructor in the Women's Junior Olympic program. The program was designed specifically for pre-school aged children who experience motor challenges. Knowledge of early childhood growth and development, physical therapy, occupational therapy, sports medicine, and kinesiology was incorporated into curriculum. The program includes six 45-minute weekly lessons over the course of six weeks. Each class includes activities and obstacles focusing on fundamental preschool gymnastics skills to develop strength, coordination, and flexibility. Lessons incorporate large and fine motor skills, motor planning, balance, and body control. More details about the course curriculum can be found in Appendix A.

Methods

Study Design

This study is a quasi-experimental pre-test and post-test design. The Developmental Coordination Disorder questionnaire was administered to participating parents at the beginning and end of each six-week session. A parent questionnaire was chosen because parent report has been found to be useful in the process of identification of developmental and movement difficulties (Bois, Sarrazin, Brustad, Trouilloud, & Cury, 2005). Parental concern about a child's development has shown to be a powerful tool for the identification of significant problems in the child, particularly children older than four years of age (Glascoe, 2003). Furthermore, parent questionnaires can provide qualitative, accurate assessment of their children's skills in a naturalistic environment (Wilson, 2000). The questionnaires were analyzed to evaluate the relationship between change in questionnaire scores and participation in the Gymnastics through Early Movement program.

Participants

Participants were recruited from the Gymnastics through Early Movement program registry. Initial contact with potential subjects was made by telephone by the lead investigator. Eligible participants included parents ages 18-65 who perceive their child (3-8 years of age) with a motor developmental delay or coordination deficit and are also enrolled in the Gymnastics through Early Movement program. Exclusion criteria includes participants unable to read and understand English and participant's child unable to walk unassisted.

Two enrollment periods resulted in five parents who met the criteria for enrollment. During the first enrollment, two parents were excluded due to their child's inability to complete

the program, a language barrier, or failure to perceive a motor challenge in their child. Three parents whose children participated in the Gymnastics through Early Movement Program were eligible. Two mothers resulting in three total students completed the questionnaires. The three children whose parents were enrolled ranged from 5 to 8 years of age, were all male, and were identified as having motor challenges by their mother. All students were able to walk unassisted. Each participating child receives accommodations or special services such as an Individualized Education Plan (IEP) during the school-year.

The Developmental Coordination Disorder Questionnaire

The Developmental Coordination Disorder Questionnaire (DCDQ) is not diagnostic, but intended for use with 5-15-year-old children to provide information on the existence of motor difficulties in children based on parents' perceptions of the children's functional skills outside of the clinic setting. The questionnaire evaluates four areas: Control during movement, fine motor/handwriting, gross motor/planning, and general coordination. The DCDQ requires parents to compare her child's coordination with other children of the same age and rate it on a 5-point Likert scale. The DSDQ sensitivity is 84.6% and the specificity is 70.8%. Internal consistency is very strong and demonstrates construct validity by differentiating between children with and without developmental coordination disorder, but it is most accurate in identifying children who may have a DCD. A score 0–48 represents those in the 0-10th percentile and is categorized as Indication Developmental Coordination Disorder. Scores 49-57 represent those in the 11-24th percentile and indicate a Suspect DCD and scores 58-85 place in the 25-100th percentile and are denoted as Probably Not DCD (Wilson et al., 2000).

Control During Movement	Fine Motor/ Handwriting	Gross Motor/ Planning	General Coordination
1. Throws ball	7. Writing fast	11. Team sports	15. Bull in china
2. Catches ball	8. Writing legibly	12. Avoid sports	16. Awkward
3. Hits ball/birdie	9. Effort & pressure	13. Ride a bike	17. Fatigues easily
4. Jumps over	10. Cuts	14. Learning skills	
5. Runs and stops			
6. Plan activity			

Table 1. Content of Each of the Four Factors of Questionnaire (Wilson, 2000)

Data Analysis

Descriptive statistics were utilized to examine the pre-and post-questionnaires. The mean and standard deviation was found for each category in addition to the total scores of the questionnaires before and after implementation of the program. Individual questions were analyzed in each category to determine commonalities among increased results.

Results

Results from the Developmental Coordination Disorder Questionnaire before and after participation in the Gymnastics through Early Movement Program were diverse. Student “A” had a pre-score of 20/75 categorized as Indication of DCD by the questionnaire. In the control during movement category his score increased from 8/30 to 10/30. His fine motor/handwriting score remained the same at 4/20. His general coordination score increased from 8/25 to 9/25. His total score increased by three points after the program to 23/75, demonstrating an increase in developmental coordination; however, his total score remains in the Indication of DCD category.

Student “C” scored 57/75 on the pre-test. This score falls on the higher range of the Suspect DCD category, however; his score increased the most (5 total points) to a 62/75 post-score which re-categorizes his score into Probably Not DCD. His improvements were found in fine motor/handwriting and general coordination.

Student “T’s” post-score decreased by three points from his pre-test score. His score in control during movement changed from 13/30 to 10/30. Fine motor/handwriting category score remained the same as well as general coordination although responses to the individual questions in this category changed. As a result, student “C” went from a 29/75 to a 26/75, both indicating a probable Developmental Coordination Disorder. His mother’s comment on the questionnaire states, “This class has helped strengthen his core and he has been able to do most of the obstacles. It was nice seeing him interact and learn to do things I was unsure if he could do.”

Intervention effected only student “C’s” scores in the fine motor/handwriting category. Across the board, the most change was seen in the general coordination category. Two out of the three students were reported by their parents to fatigue less easily, improve posture, and lessen clumsiness. One student achieved a higher score on ability to learn new skills and being quick and competent in activities of daily living. Two out of the three students increased total scores by 3-5 points over the six-week course. Mean scores for control decreased from 14.7 to 14.3 while fine motor means increased from 8 to 8.3. Coordination mean scores also increased from 12.6 to 14.3. The means of the total scores increased from 37 to 41. A summary of these results can be found in Table 2. Overall participation in the Gymnastics through Early Movement program had a positive effect on the majority of parent perception of the students’ developmental and

coordination skills and all participants reported the program as valuable and fun for their children.

Student	Control Scores		Fine Motor Scores		Coordination Scores		Total scores	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
A	8	10	4	4	8	9	20	23
C	23	23	15	16	19	23	62	75
T	13	10	5	5	11	11	29	26

Table 2. Questionnaire Scores

Discussion

Limitations

Several limitations were present in this study that affected the ability to effectively determine if the Gymnastics through Early Movement program has a clinical significance on motor coordination and development. The first limitation was the small sample size due to classes being offered in only one location and low total enrollment in the program. Pre-school gymnastics enrollment is typically lower in the summer and the facility experienced a decreased enrollment throughout classes; however, there was a disconnect between the amount of interest and the number of students who enrolled. The program was scheduled in the summer in the attempt to bridge the gap left by state funded interventions.

Participants were all female and answered questions about their all male children which may also limit the generalizability of the study findings. Motor development and coordination was assessed by the parents rather than a clinical professional which may have affected the accuracy of the results, especially in the case of the student whose motor development and coordination skills reportedly decreased after intervention.

The selected questionnaire was an additional limitation. Though it was an acceptable indicator of parent perception of a child's coordination skills, it failed to identify additional benefits the program may have offered such as balance, muscle tone, motor planning, focus-control, flexibility, and confidence.

The largest limitation was the need for adaptation of the curriculum. In addition to motor challenges, co-existing conditions such as Autism Spectrum Disorder and Disruptive Behavioral Disorder were also present and affected adherence to scheduled activities. Two of the three children had difficulty following directions and staying on task, requiring the instructor to modify planned lessons in the moment based on the child's willingness to participate and mental ability level. Student "C" whose scores showed a significant increase was the only one able to fully participate and complete all scheduled activities and obstacles. Furthermore, there may have been unforeseen factors occurring in the clinic setting or in the community that could have impacted the outcome of this study. The study concluded after six-weeks of participation which may be the minimum required time to develop improvements in motor skills. It is unknown if continuation of the program or re-enrollment in additional sessions would result in further benefits. Because the project was completed over the course of six-weeks, the sustainability of the effect of the program cannot be demonstrated.

Implications For Future Practice

The results of this study indicate implications for the future. There is a need for further research to identify specific activities that improve a child's motor development and coordination outside of a clinical setting. Additional studies of the Gymnastics through Early Movement, conducted with larger sample sizes and control groups are needed to determine the effectiveness

on a parents' perception of a child's motor abilities. In the future, participation criteria should exclude co-existing mental conditions in children that may affect ability to complete the program as designed. The length of the program may need to be extended to maximize motor progress and follow-up studies are needed among participants to determine sustainability of the results.

Conclusion

In conclusion, the Gymnastics through Early Movement Program may be beneficial to motor developmental delays or coordination disorders found in early school-aged children. The study showed improvements in general coordination and motor control after participating in the six-week program. Specific advances were found in endurance, posture, and clumsiness and overall scores on the DCDQ. The Gymnastics through Early Movement program appears to be a valuable early intervention program that can be offered in a non-clinical setting and is fun for children who have motor developmental delays and coordination deficits.

Appendix A: Gymnastics through Early Movement Curriculum

	Week One	Week Two	Week Three	Week Four	Week Five	Week Six
10 minutes	Warm-up	Warm-up	Warm-up	Warm-up	Warm-up	Warm-up
10 minutes	Circuit 1	Circuit 4	Circuit 7	Circuit 1	Circuit 4	Circuit 7
10 minutes	Circuit 2	Circuit 5	Circuit 8	Circuit 2	Circuit 5	Circuit 8
10 minutes	Circuit 3	Circuit 6	Circuit 9	Circuit 3	Circuit 6	Circuit 9
5 minutes	Slide Time/Free Play					

Warm up (*Follow the Leader Style*):

Activity	Description	Focus Area
Running	Forward jog, Backward jog	Gross Motor, Endurance
Bunny Hop	Small two foot jumps	Gross Motor, Coordination
Frog Jumps	Large squat jumps	Gross Motor, Strength
Bear Walks	Legs straight, arms straight, hands and feet on floor walking	Gross Motor, Coordination
Flamingo Hops	One leg jumps	Balance, Coordination, Strength
Stretching (Sometimes done with stuffed animals, foam blocks, beach ball etc. depending on theme)	Squat-stands, Reaching/arm circles, Straddle sit and lean, butterfly, pike sit, long steps, seal stretch, cat back	Flexibility; Range of Motion
Table tops	Make flat surface by lifting hips up; feet and hands on floor	Strength, Posture
Teepee Hold	Reverse pike hold, hands and feet on floor	Strength
Donkey Kicks	Hands on floor, jump and kick butt with feet	Strength, Coordination, Weight Transfer

Circuit 1

<u>Activity</u>	<u>Description</u>	<u>Focus Area</u>
Cat walk	Walk on the floor beam	Balance
Crawl through the bear cave	Through the tunnel	Gross Motor
Kangaroo Jumping	Straight two foot jumps on spring board	Focus Control, Coordination
Monkey Swings	Hang on baby bars, run and swing on bars	Fine Motor
Rolly Poly Roll	Log roll down wedge	Coordination, Vestibular Exposure
Flamingo Pose	One leg stand on mushroom for 3 seconds	Balance, Focus Control

Circuit 2

(On Tumble Trak)

<u>Activity</u>	<u>Description</u>	<u>Focus Area</u>
Bunny Hop	Small two foot jumps	Coordination
Backwards Jump	Jumping backwards on trampoline	Coordination
Seat Drops	Jump to sit, bounce back to stand	Coordination, Motor Planning
Sideways Jumps	Jumping facing one side then the other	Coordination
Tuck Jumps	Jump, bend knees in air up to chest	Coordination, abdominal and leg strength
Straddle Jumps	Jump, straddle legs in air, return together before landing	Coordination, Motor Control
Donkey Kicks	From knees, jump to hands and return to knees	Coordination, Weight Shifting
Jump Over	Jump over obstacles in the path	Motor Planning, Coordination
Running	Run across trampoline and jump into foam pit	Speed, Coordination

Circuit 3

<u>Activity</u>	<u>Description</u>	<u>Focus Area</u>
Pit Crawl	Crawl through foam pit over dispersed mats	Motor Planning, Strength
Rope Swing	Sit on knot in rope, hold on with arms, swing out over pit	Fine motor, Strength
Rock Jumps	Climb up to vault table (4 feet tall) jump off into pit	Motor Planning,
Beam Crawl	Crawl across beam over foam pit, looking forward	Balance, Focus Control, Coordination
Build Tower	Build towers of 3 pit blocks, kick them down	Gross Motor

Circuit 4

<u>Activity</u>	<u>Description</u>	<u>Focus Area</u>
Straight Jumps	Run down runway, jump on spring board, jump onto resi	Speed, Coordination
Hula Hoop maze	Step one foot into hula hoops laid adjacent to each other	Motor Control
Sit up throw	Lay flat, holding item, sit up to throw it at target	Abdominal and arm strength
Leap to music dots	Using far apart music dots they should long step/leap to each one	Spatial Awareness
Handstand	Handstand on wall, walking feet up to get in position	Arm Strength, Body Awareness
Scarf Throw and Catch	Throwing scarves and catching scarves before they hit the ground	Tracking

Circuit 5

(On low beams)

-For each activity the focus area is balance

<u>Activity</u>
Forward Walk
Backward Walk
Side Walk
Bunny Hops
Ice-cream Scoops
Step Over Blocks
Crawl Across
Scarf Toss
Turn Arounds
Releve Walking
Stick it game (jumping off and trying to freeze)

Circuit 6

<u>Activity</u>	<u>Description</u>	<u>Focus Area</u>
Net Climb	Climbing up and across net	Coordination, Strength
P-bars Bear Walk	Bear walks on top of parallel bars	Balance, Coordination, Motor planning
L- hold photo	Hold L shape on pommel horse for 1-3 seconds	Strength
Ring Swings	Hold on rings with hands and swing	Fine Motor, Strength

Circuit 7

<u>Activity</u>	<u>Description</u>	<u>Focus Area</u>
Resi Wall	Run and climb up resi turned vertical	Strength, Coordination
Beach Balls	Throwing and catching beach balls	Tracking, Coordination
Crawl up beam	Crawl up elevated beam	Balance
Ladder	Go down ladder correctly	Coordination, Gross Motor
Crab walk carry	Carry item on stomach while doing a crab walk	Strength, Coordination

Circuit 8

<u>Activity</u>	<u>Description</u>	<u>Focus Area</u>
Handstand Fallovers	Climb to handstand position and fall over to back	Coordination, strength
Forward Rolls	Forward roll down wedge or on floor as able	Motor control, body awareness
Slider Walks	Using sliders on feet or hands, crawl or run with hands on floor	Balance, Coordination, Strength
Simon Says	Practice static shapes and positions	Following Instructions, Memory

Circuit 9

<u>Activity</u>	<u>Description</u>	<u>Focus Area</u>
Pull overs	Stand with chin over bar and run up wall or use spot pull over to front support	Strength
Side Shuffle on Bar	Walk hands across bar while hanging	Fine motor, strength
Swing and let go	Swing on high bar and drop into foam pit	Fine motor, strength
Climb Ladder	Climb ladder properly	Gross motor, coordination
Pick up leg lifts	Lying on back pick up item between feet and put in basket on either side of feet	Abdominal strength, coordination, motor control

Potential Cognitive Benefits

Following Instructions (One step and multi-step)
Turn taking
Confidence
Counting
Color Recognition
Sensory Integration
Vestibular Motion Integration

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