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Power to Go: Meeting the Needs of Pediatric Power Mobility Learners

Lisa K. Kenyon PT, DPT, PhD, PCS

Learning Outcomes

After this course, participants will be able to:

- Compare and contrast at least two characteristics of learners in each of the thee power mobility learner groups.
- Identify at least four features of power mobility interventions targeting learners in each of the following groups: exploratory learners, operational learners, and functional learners.
- List at least three outcome measures that can be used with learners in each of the following groups: exploratory learners, operational learners, and functional learners.
- Discuss at least two appropriate expectations of power mobility interventions for learners in each of the following groups: exploratory learners, operational learners, and functional learners.

Acknowledgment

Thank you to the families who have given their permission to show photographs and videos of their children, to use the children's first names, and to describe the children's condition and abilities during this presentation.

Benefits of Power Mobility Use for Children With Mobility Limitations

Benefits of Power Mobility Use in Children[8]

BODY STRUCTURE AND FUNCTION

- Developmental change
- Heart rate
- IQ
- Affect
- Engagement
- Sleep/wake pattern
- Psychological impact

ACTIVITY

- PWC mobility
- Self-initiated mobility
- Interaction with objects
- Communication
- Independence
- Driving time and distance
- Mobility
- Cause & effect
- Hand use

PARTICIPATION

- Social interaction
- Play skills
- Social skills
- Peer participation
- Social roles
- Education
- Responsibility
- Interpersonal relationships

Livingstone & Paleg 2014[2]

- Power mobility is beneficial for children who
  - Will never walk
  - Have inefficient mobility
  - Lack efficient, independent mobility in early childhood

Livingstone & Paleg 2014[2]

- Power mobility is beneficial for children who
  - Will never walk
  - Have inefficient mobility
  - Lack efficient, independent mobility in early childhood
  - Have multiple, severe disabilities and may never become independent community drivers

Benefits of Power Mobility Training in Children With Multiple, Severe Disabilities - Videos

CONTINUED

Power Mobility Learner Groups[3]



CONTINUED

Power Mobility Learner Groups[3]



Power Mobility Learner Groups[3]



Power Mobility Learner Groups[3]



Power Mobility Learner Groups[3]



Exploratory Learners

Field & Livingstone 2018[3]

- All young children begin power mobility use as 'exploratory learners'
- Learner group is determined by
  - The speed at which a child progresses

Exploratory Learners[3]

- Typically remain in this learning stage for a prolonged time
- Includes children with cognitive limitations or sensory impairments (visual deficits, CVI, etc.)
  - May remain at this level for protracted periods
  - May never progress to the Operational power mobility learner group

Exploratory Learners[3]

- Learner needs
  - Frequent assistance
  - **Very close** adult supervision – 100% of the time

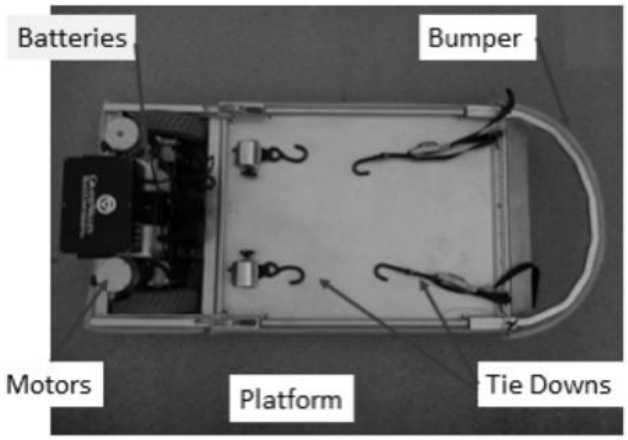
Exploratory Learners[3]

- Training methods
  - Encourage self-initiated mobility through engagement in individually motivating activities
  - Mimic development of independent mobility skills in typically developing children
- Training environment
  - Controlled settings
  - Familiar environments

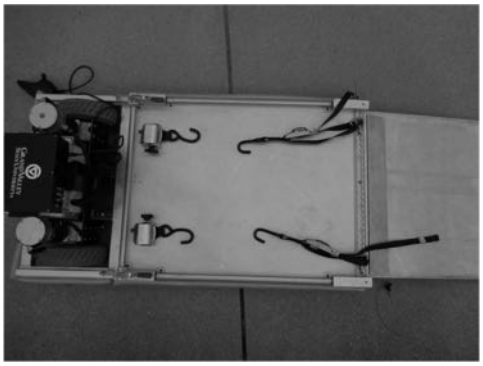
Exploratory Learners[3]

- Power mobility devices
  - Alternative power mobility devices
  - Shared or loaner equipment
  - Modified battery operated ride-on toys (operated with a single switch)

Our Power Mobility Devices



Trainer with Loading Ramp Extended



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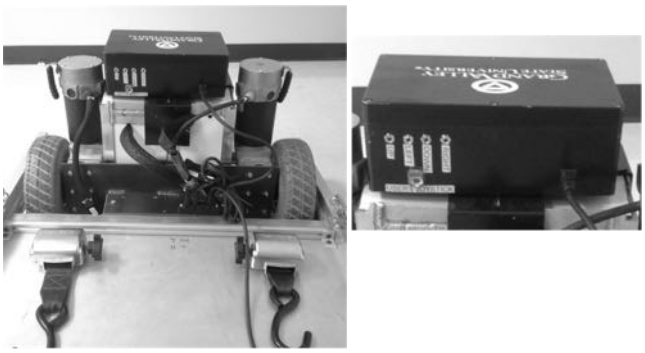
Trainer Interface and Controls



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Exploratory Learners[3]

- Assessment tools – tool choice is goal dependent
  - Goals related to
    - Development
    - Exploration
    - Power mobility skills

Exploratory Learners[3] - Assessment Tools

- Goals related to development
- Goals related to exploration
- Goals related to power mobility skills

Exploratory Learners[3]

- Expectations
  - May never become independent community-based PWC users
    - This is OK!!!!
    - Previous work in this area[4-8]
      - Cognitive skills
      - Social skills
      - Problem solving skills
      - Mastery motivation

Exploratory Learner #1

Using PM for Exploration and Learning[3]

Case Description

- 17 month-old girl with spastic quadriplegic cerebral palsy (GMFCS Level V; Mini-MACS Level V)
- CVI, seizures
- Desired Outcomes: To develop cause and effect skills and learn how to use a switch

Tests and Measures

- Pediatric Evaluation of Disability Inventory—Computer Adaptive Test (PEDI-CAT)
- The Dimensions of Mastery Questionnaire (DMQ)
- Tracked the number of switch activations

Intervention - Video

- Power mobility training 60 minutes per week for 12-weeks
- Device: Play & Mobility Device
- Started with 1 switch

Video

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Video

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Outcomes – PEDI-CAT

Domain	Pre-Intervention	Post-Intervention
Daily Activities Scaled Score	30	30
Mobility Scaled Score	41	43
Social/Cognitive Scaled Score	40	46
Responsibility Scaled Score	25	25

Outcomes – PEDI-CAT

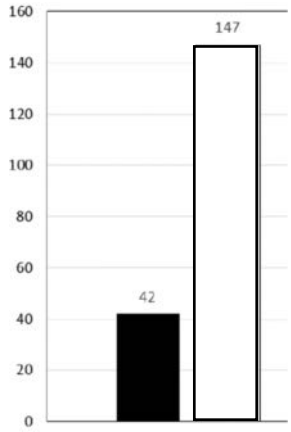
Domain	Pre-Intervention	Post-Intervention
Daily Activities Scaled Score	30	30
Mobility Scaled Score	41	43
Social/Cognitive Scaled Score	40	**46**
Responsibility Scaled Score	25	25

Outcomes – DMQ & Switch Activations

- Post-intervention
  - Higher scores in
    - Social persistence with adults
    - Expressive mastery motivation

Outcomes – DMQ & Switch Activations

- Post-intervention
  - Higher scores in
    - Social persistence with adults
    - Expressive mastery motivation



A Word About Expectations…

Using PM for Exploration and Learning[3]

Video

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Video

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Video

Using PM as an Intervention

Exploratory Learners[3]

- Expectations
  - Power mobility training can also be used as an intervention even though PWC use is not the expected outcome[10]
  - In such instances, children gain benefits from exploring the use of power mobility even though the goals of power mobility use do not relate to long term use of a PWC

Exploratory Learner #2

Using PM as an intervention[9]

Case Description

- 4 year, 2 month-old boy with triplegic cerebral palsy (GMFCS Level IV) and an autism spectrum disorder
- Good postural control and excellent balance in sitting
- No interest in locomotion tasks
- Desired Outcomes: developing cause and effect skills and interacting with the environment

Tests and Measures

- Assessment of Learning Powered mobility use
- Canadian Occupational Performance Measure
- Maternal interview

Intervention - Video

- Power mobility training 45-60 minutes per week for 16-weeks
- Device: Trialed Power Wheelchair Trainer; intervention provided with Play & Mobility Device
- Started with 1 switch

Power Mobility as an Intervention

- Emphasized development of
  - Cause and effect skills
  - Tool use
- Purposeful movement and play
- Environmental exploration

Intervention – Introducing a 2nd Switch Video

Intervention – Video - Joystick Use

Outcomes

- Assessment of Learning Powered mobility use
  - ALP Phase 1 (Novice - limited understanding of cause and effect use) to a Phase 5 (Sophisticated Beginner - conscious of cause and effect)

Outcomes - COPM

Occupational Performance Problem	After First Session Performance/Satisfaction		End of 12 Weeks Performance/Satisfaction	
Cause and Effect Skills	2	1		
Interacting with His Environment	4	4		
Using Power Mobility to Obtain a Desired Object	1	1		
Using More than One Switch	1	1		

Outcomes - COPM

Occupational Performance Problem	After First Session Performance/Satisfaction		End of 12 Weeks Performance/Satisfaction	
Cause and Effect Skills	2	1	9	9
Interacting with His Environment	4	4	7	9
Using Power Mobility to Obtain a Desired Object	1	1	4	2
Using More than One Switch	1	1	9	10

Outcomes – Caregiver Interview

- Perceived improvements in child's understanding of mobility.
- Child exploring home using a scooting pattern and appeared to be more "interested" in moving
- Started using a walker
  - Tool use

Follow Up

- In the months following power mobility intervention, child emerged with independent ambulation in all environments
  - Even started running!!!!

Exploratory Learner #3

Using PM as an intervention[9]

Case Description

- 3 year, 21 month-old boy
  - 15 months post-acquired brain injury
- Previously typically developing
- Able to sit and do very limited crawling. Unable to use a walker
- Desired outcomes: increasing interactions with other people and exploring his environment

Tests and Measures

- Assessment of Learning Powered mobility use
- Pediatric Evaluation of Disability Inventory – Computer Adapted Test
- Wheelchair Skills Checklist
- Canadian Occupational Performance Measure
- Caregiver interview

Intervention - Video

- Power mobility training 45-60 minutes per week for 12-weeks
- Device: Power Wheelchair Trainer
- Started with 1 switch
- By the end of the first session, was using 3 switches
- Quickly went to a joystick

Intervention – Using Joystick First Time Video

Power Mobility as an Intervention

- Encouraged problem-solving
- Making choices and decisions
- Opportunities to hone attention and spatial awareness skills

Outcomes

- Assessment of Learning Powered mobility use
  - Phase 4 (Advanced Beginner) to a Phase 7 (Proficient)
- Pediatric Evaluation of Disability Inventory – Computer Adapted Test
  - Daily Activities
- Wheelchair Skills Checklist
  - Performed 7 of 7 skills

Outcomes - COPM

Occupational Performance Problem	After First Session Performance/Satisfaction			
Driving with joystick	1	1		
Maneuvering the Trainer	2	1		
Moving to desired objects/people	1	1		
Purposefully stopping	4	3		
Interacting with people	1	1		

Outcomes - COPM

Occupational Performance Problem	After First Session Performance/Satisfaction		End of 12 Weeks Performance/Satisfaction	
Driving with joystick	1	1	9	10
Maneuvering the Trainer	2	1	9	10
Moving to desired objects/people	1	1	9	10
Purposefully stopping	4	3	10	10
Interacting with people	1	1	8	10

Outcomes – Caregiver Interview

- Child described as happy
- Child not having as many outbursts or tantrums
- Saying more words and putting words together
- Improvements in mobility skills when not using the Trainer
  - Started using a walker
  - Started propelling and maneuvering his manual WC

Follow Up

- In the months following power mobility intervention, child emerged with independent ambulation in all environments
  - Even started running!!!!

A Note About Outcome Assessment Tools for Exploratory Learners

The Power Mobility Training Tool – PMTT[14]

- Used to identify basic power mobility skills in children
  - Can be used with children who use **switches** or other alternative access methods
- **Guides the development of power mobility training programs** to promote basic power mobility skills

The PMTT[14]

- **Not intended to determine who "qualifies" for power mobility**
- Not intended to be used as an outcome measure BUT…
  - Field & Livingstone 2018
- Consists of
  - 12 items scored on a 5 point scale
    - 4 non-motor items and 8 motor items
  - 1 non-scored item
  - 2 items that are scored dichotomously

Provided by the authors free of charge

Operational Learners

Operational Learners[3]

- Need an extended period of time learning the basic skills related to operating a power mobility device
- Expectations are influenced by the environment

Operational Learners[3]

- Learner needs
  - Close adult supervision
  - Intermittent assistance

Operational Learners[3]

- Training methods
  - Play activities that incorporate basic power mobility skills
  - Lots of practice opportunities
- Training environment
  - Controlled settings - often in 1 or 2 environments only

Operational Learners[3]

- Power mobility devices
  - Alterative power mobility devices
  - Shared or loaner equipment
  - Modified battery operated ride-on toys - if have more than an a single switch or have a joystick

Operational Learners[3]

- Assessment tools
  - Again dependent on goals

Operational Learners[3]

- Expectations
  - Children using alternative access methods often fall into this learner group
  - May or may not progress to becoming independent community PWC users
    - This is OK!!!!
  - Non-child related factors may come into play[10,11]

Operational Learner

Alternative access method – tongue access

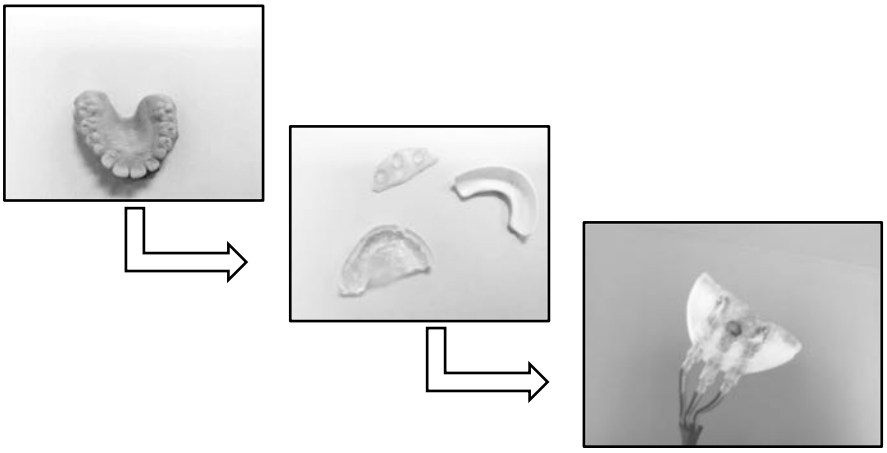
Case Description

- Spastic athetoid CP
  - GMFCS Level V
  - MACS Level V
  - CFCS Level III
  - EDACS Level I
- Started with us at 7 years-old
- Access issues

Tests and Measures

- Assessment of Learning Powered mobility use
- Wheelchair Skills Checklist (WSC)
- Canadian Occupational Performance Measure

Bite-Splint Device



Intervention

- Power mobility training 45-60 minutes per week for 12-weeks
- Device: Power Wheelchair Trainer
- Involved play and activities focused on the operation of the device
- Environmental set up

Intervention – Early Training Video

Video – “Running” the Bases

Outcomes

- Assessment of Learning Powered mobility use
  - Phase 4 (Advanced Beginner) to a Phase 7 (Proficient)
- Wheelchair Skills Checklist
  - Performed 6 of 7 skills – all but reverse
  - Did not have an option for reverse

Outcomes - Driving Skills Achieved

- Forward down hallways
- Right and left turns
- 360 degree spins to each side
- Stopping in response to environmental cues
- Through doorways and narrow spaces
- Maneuvering
- Approaching furniture without running into it

Outcomes - COPM

Occupational Performance Problem	After First Session Performance/Satisfaction			
Sustaining forward movement 20-25 ft	2	9		
Turning right	2	8		
Turning left	2	8		
Simple maneuvering	2	9		
Stopping	3	9		

Outcomes - COPM

Occupational Performance Problem	After First Session Performance/Satisfaction		End of 12 Weeks Performance/Satisfaction	
Sustaining forward movement 20-25 ft	2	9	8	10
Turning right	2	8	9	10
Turning left	2	8	9	10
Simple maneuvering	2	9	8	10
Stopping	3	9	9	10

Follow Up

- Non-Child factors
  - Other factors influencing functional PWC use and readiness for an individually prescribed PWC

Functional Learners

Functional Learners[3]

- Progress quickly through exploratory and operational stages
- Focused on integrating use of a power mobility device into daily life activities

Functional Learners[3]

- Learner needs
  - Age appropriate supervision
  - Supervision is often provided from a short distance away
    - Depends on the child's confidence, abilities, and age as well as the environment

Functional Learners[3]

- Training methods
  - Refining power mobility skills
  - Progressively more complex situations and environments
  - Integrating power mobility device into daily life experiences
- Training environment
  - Progressively variable settings
    - Towards more open (unpredictable) environments

Functional Learners[3]

- Power mobility devices
  - Shared or loaner equipment
  - May ‘qualify’ for an individually prescribed PWC

CONTINUED

Functional Learners[3]

- Assessment tools
  - Again, goal dependent but goal here is often related to 'qualifying' for a PWC
    - Confidence in PWC use may also be a goal
  - Improving functional use of power mobility in daily life
    - Research suggests that this may be an on-going process[11]
    - May benefit from check-ins and additional training[3]

CONTINUED

Functional Learners[3]

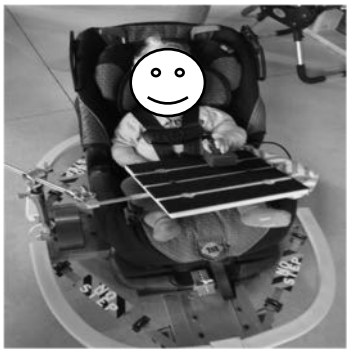
- Expectations
  - Functional learners may start as young exploratory learners who relatively speaking, quickly progress towards 'qualifying' for a PWC

Functional Learner

Progression from a young exploratory learner to 'qualifying' for a PWC

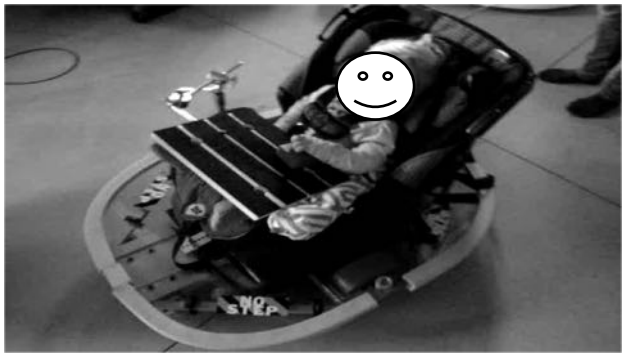
Case Description

- Spinal muscular atrophy – type I
- Started with us at 11 months using a single switch
- Device: Play & Mobility Device
- Custom-designed joystick
- Power mobility interventions provided at home
  - Play with brother and peers



Video – First Session

Video – First Session at Home



Follow Up

Functional PWC Use!!!

Summary

Select Outcome Assessments

Power Mobility Learner Group	ALP	COPM	WSC	PEDI-CAT	?PMTT
Exploratory PM Learners	X	X	X – Depends on goals	X – Depends on goals	Maybe?
Operational PM Learners	X	X	X	X – Depends on goals	
Functional PM Learners	X	X – or WHOM-YP		X – Depends on goals	

Select Outcome Assessments

Other Possible Assessment Tools for Functional Learners

- PMP
- WST for Power Wheelchairs
- The Wheelchair Use Confidence Scale for Children (Rushton)

Select Power Mobility Training Methods

Exploratory PM Learners

- Cause & effect
- Exploration
- Choices & decisions
- Play

Operational PM Learners

- Play
- Operation of the device
- Environmental set up

Select Power Mobility Training Methods

Possible PM Training methods for Functional Learners

- PMP
- WST for Power Wheelchairs
- Participation in daily life activities

Outcome Expectations for Different PM Learner Groups

Expectations

Exploratory PM Learners

- May need extended practice periods
- May progress to Operational PM Learner group
- May stay in Exploratory PM Learner group - that's OK!

Operational PM Learners

- May need extended practice periods
  - Especially when using alternative access methods
- May progress to Functional PM Learner group
- May stay in Operational PM Learner group - that's OK!

Expectations for Functional PM Learners

- New situations may present new challenges
  - Learning to use a PM device is a on-going process[11]

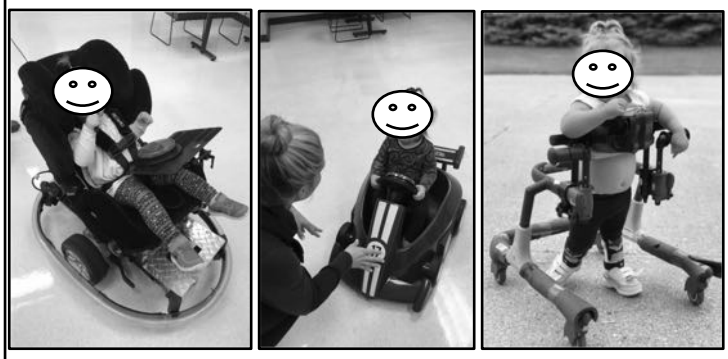
The Need for Multiple Mobility Options

Multiple Mobility Options

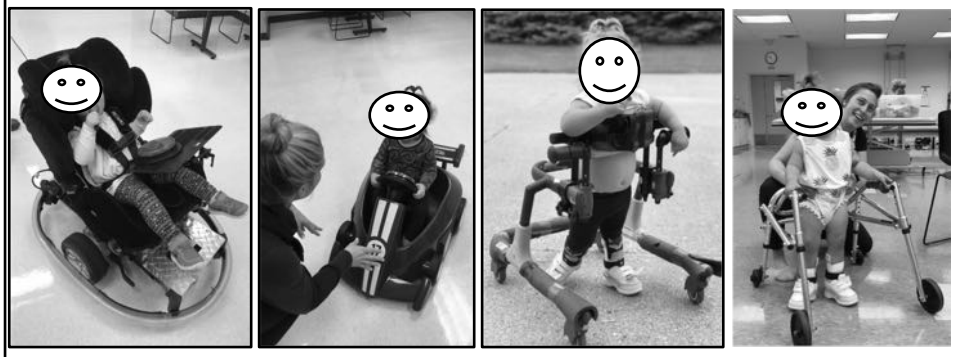
Multiple Mobility Options

Multiple Mobility Options

Multiple Mobility Options



Multiple Mobility Options



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Questions?
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