



Promoting Physical Literacy in Early Childhood: Evidence-Based Recommendations from SKIP

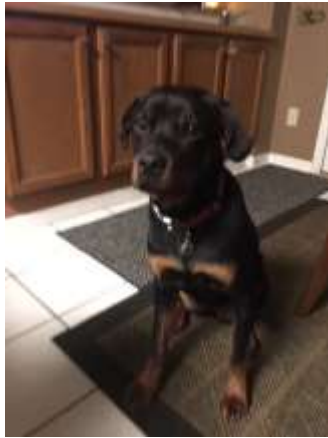


Professor Jacqueline D. Goodway PhD
Department of Human Sciences, Kinesiology
Crane Center for Early Childhood Research & Policy
The Ohio State University



Ohio to Israel

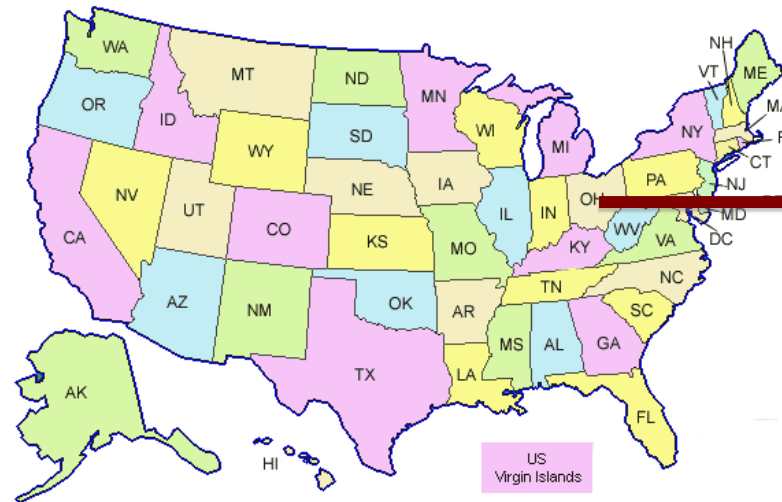
Sadie – 14 months



Husband Scott



Blaize - 17





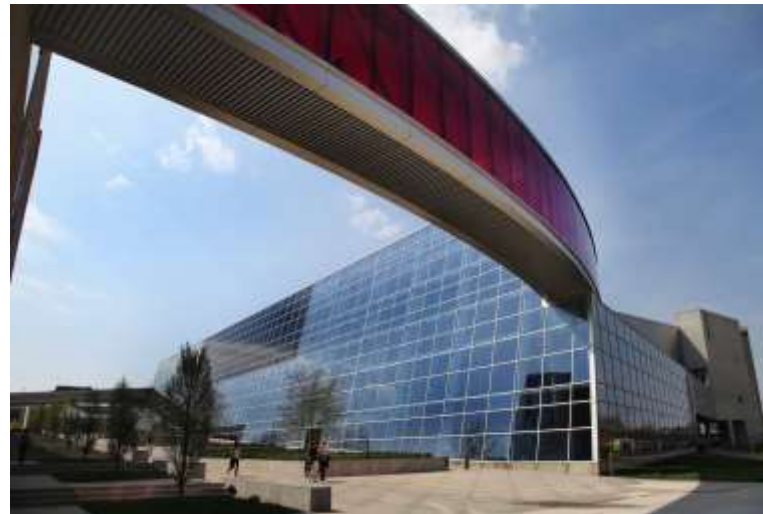
Recreation & Physical Activity Center



Aquatics Area



- ◆ \$140 million Recreation & Physical Activity Center (PRAC)
- ◆ RPAC is 569,459 square feet
- ◆ Student recreation has 5 indoor locations & 90 acres of outdoor space





The Ohio State University



60,000 students – one of the largest public universities in the USA

200 academic majors

12,000 different academic courses

26 libraries

Entire indoor & outdoor spaces wired for Wifi



Brutus Buckeye





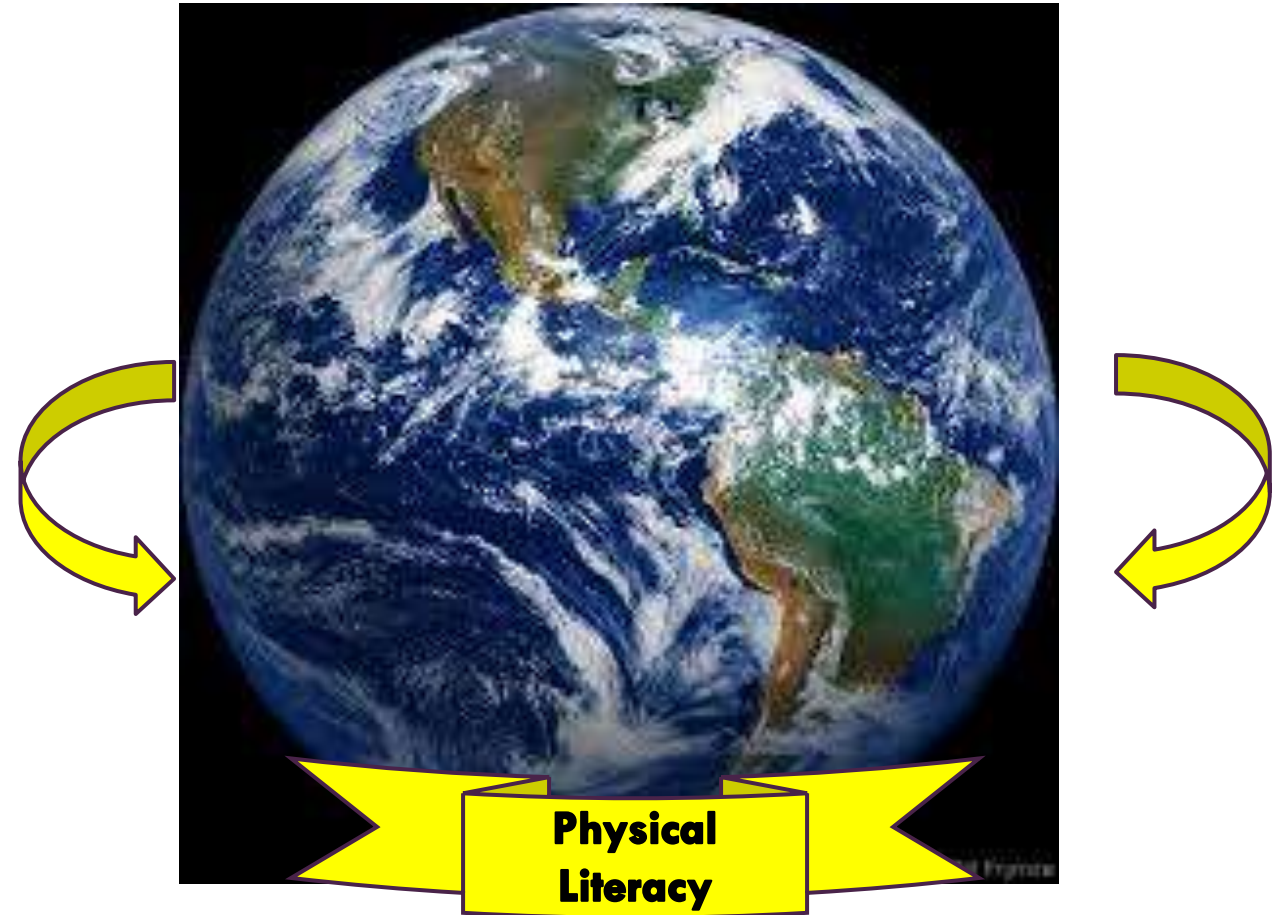
Different Developmental Trajectories





Physical Literacy is an Increasing Global Concept

- Physical literacy is a concept that is gaining world wide attention.
- Many countries are beginning to develop physical literacy policies and implications for professional practice in sport and physical education.
- Many countries are investing significant resources into physical literacy.





Definitions of Physical Literacy

- Physical literacy can be described as the motivation, confidence, physical competence, knowledge and understanding to value and take responsibility for engagement in physical activities for life. (IPLA, 2017; Whitehead, 2013)



Dr. Margaret Whitehead



Whitehead's Phenomenological View of PL

- **Phenomenology** – perception is reality.
- **Existentialism** – we create our own reality.
- **Monism** - body & brain/mind are one
 - vs. dualist view of body houses brain & is inferior to it.
- **Embodiment** – mind/body symbiosis.
- **To become physically literate is to be embodied - “I am a mover”**



“It is through physical embodiment that humans create themselves as they interact with their surroundings’

(Whitehead, 2010, pg. 26).



History of Physical Literacy

We must prepare for **physical literacy** as well as for mental literacy. A physically fit America becomes more necessary with modern mechanical inventions.

God gave the child the instinct to play; man must provide the playground. **Public schools are responsible for physical literacy** as well as mental literacy.

Physical illiteracy is on an increase in this country. In the future it will be increasingly more difficult for boys and girls to live physically well and to keep fit.

The value of physical education (or **physical literacy**) has proven its worth to the extent that recognition, and often requirement, is exacted for graduation from grammar and high schools.

1930

FM radio Invented



1931

1st Jet Engine Invented

1933



Games, climbing, walking, dancing and manual occupations such as carpentry, building and so on, all conduce to **physical literacy**: that is to a disciplined command over the body.

1937

Kriellaars et al., in press



Canadian Physical Literacy



Physical literacy constructs:

- Motivation and confidence (affective)
- Physical Competence (physical)
- Knowledge & understanding (cognitive)
- Engagement in physical activities for life (behavioral)

Physical literacy 5 Core Principles:

- ✓ is an inclusive concept accessible to all.
- ✓ represents a unique journey for each individual.
- ✓ can be cultivated and enjoyed through a range of experiences in different environments and contexts (e.g. land, water, snow, ice, air).
- ✓ needs to be valued and nurtured throughout life.
- ✓ contributes to the development of the whole person.

Community-Based Physical Literacy

Programming:

- Mother and baby programs to Senior programs
- Variety of environments: sport, outdoors, adventure, aquatics etc.



Wales Institute for Physical Literacy



- ❑ **Foundation Phase** – (4-8 years) An early years holistic curriculum in Wales that focuses on learning through physical literacy.
- ❑ Physical Literacy is a lifelong journey starting in the early years when we begin to learn about our bodies and how we move.
- ❑ Promote lots of experiences and opportunities to move & play in a variety of different environments that change across the lifespan.
- ❑ Physical Literacy is more than the development of physical skills (as it is described in some places). It is a holistic concept that is greater than the sum of it's parts.



ATHROFA LLYTHRENNEDD
CORFFOROL CYMRU
WALES INSTITUTE FOR
PHYSICAL LITERACY



Dr. Nalda Wainwright
Director, Wales Institute for PL



Australian Physical Literacy



- ❖ *Physical literacy is lifelong holistic learning acquired and applied in movement and physical activity contexts. It reflects ongoing changes integrating physical, psychological, cognitive and social capabilities.*
 - ❖ *It is vital in helping us lead healthy and fulfilling lives through movement and physical activity.*
- **Physical:** the skills and fitness a person acquires and applies through movement.
 - **Psychological:** the attitudes and emotions a person has towards movement and the impact these have on their confidence and motivation to move.
 - **Cognitive:** a person's understanding of *how, why* and *when* they move.
 - **Social:** a person's interaction with others and the environment in relation to movement.



USA Physical Literacy



- **PLAY** (Physical Literacy in All Youth) - is the ability, confidence, and desire to be physically active for life. (Aspen Institute)



www.shutterstock.com · 110955200

- **SHAPE America Physical Education National Standards:**
To pursue a lifetime of healthful physical activity, a physically literate individual:
 - ✓ Demonstrates competency in a variety of motor skills & movement patterns.
 - ✓ Applies knowledge of concepts, principles, strategies & tactics related to movement and performance.
 - ✓ Demonstrates knowledge & skills to achieve & maintain a health-enhancing level of physical activity & fitness.
 - ✓ Exhibits responsible personal & social behavior that respects self & others.
 - ✓ Recognizes the value of physical activity for health, enjoyment, challenge, self-expression &/or social interaction.



8 Components of Physical Literacy

Review of 50 Studies

- **AFFECTIVE**

- Confidence, Motivation, Self Esteem

- **COGNITIVE**

- Knowledge & Understanding

- **PHYSICAL CAPABILITIES**

- Movement Capacities, Motor Skill Competence, Physical Competence, Fundamental Motor Skills, Purposeful Physical Pursuits

- **TARGET AUDIENCE**

- Children, Adults, All

- **PROGRESSION DEVELOPMENTAL PATHWAY**

- Lifespan, Unique journey, Long Term Athlete Development

- **HOLISTIC CONCEPT**

- Environment, Journey, Holistic human being

- **PSYCHOLOGICAL, SOCIAL, ATTITUDINAL**

- Engagement, Enthusiasm & Enjoyment during Physical Activity, Support from Significant Others, Cognitive and Academic Performance

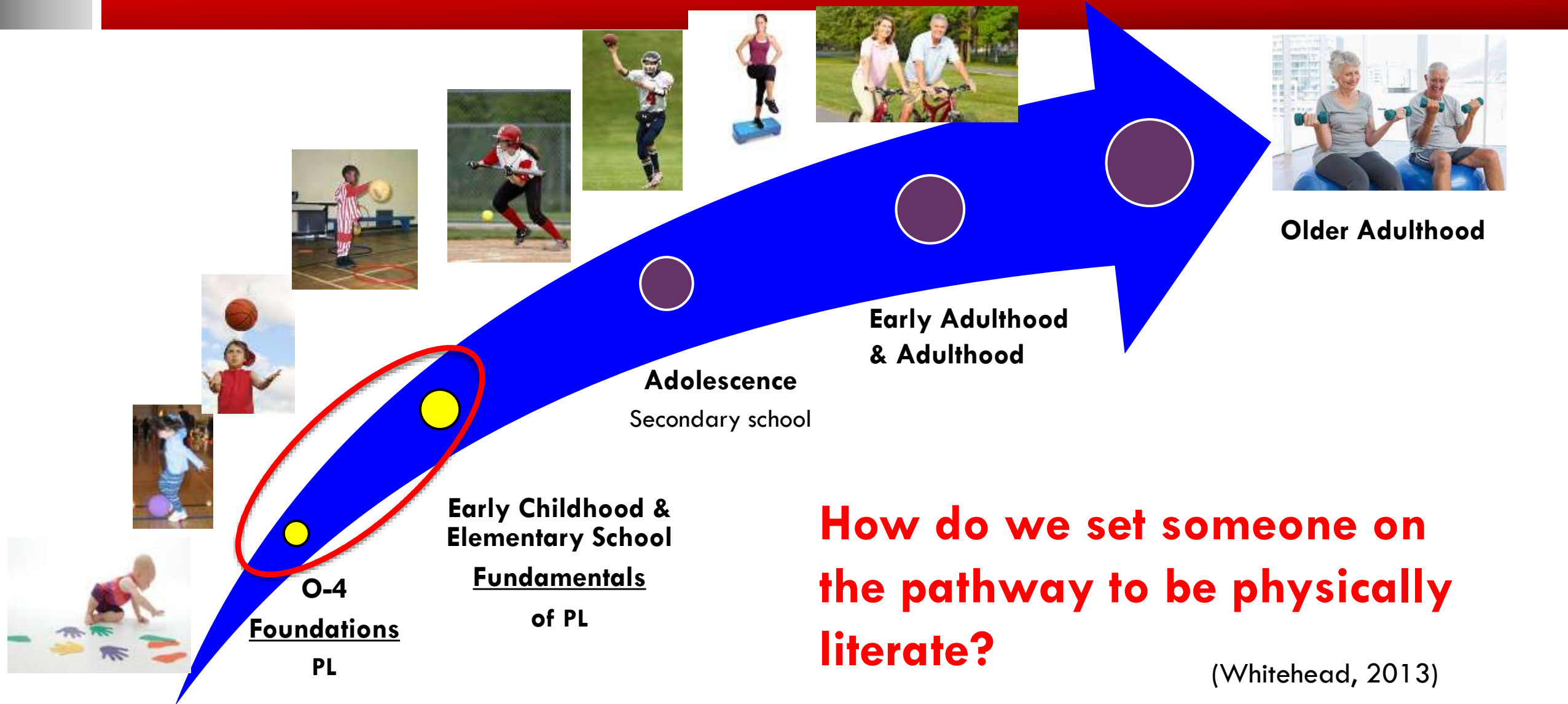
- **CONTEXTUAL FACTORS**

- PE & Sport where PL is developed

Edwards, Bryant,
Keegan, Morgan &
Jones, 2016



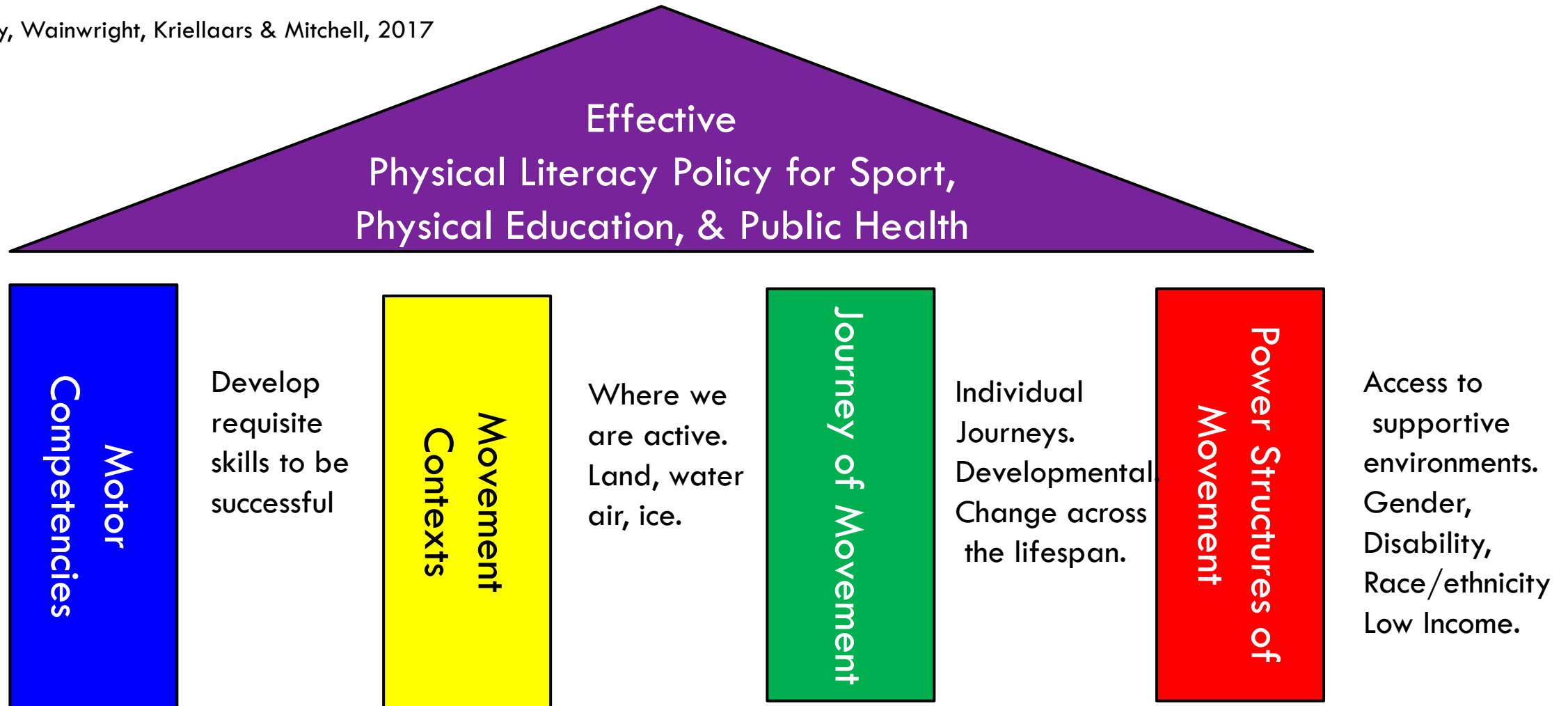
Developmental Perspective





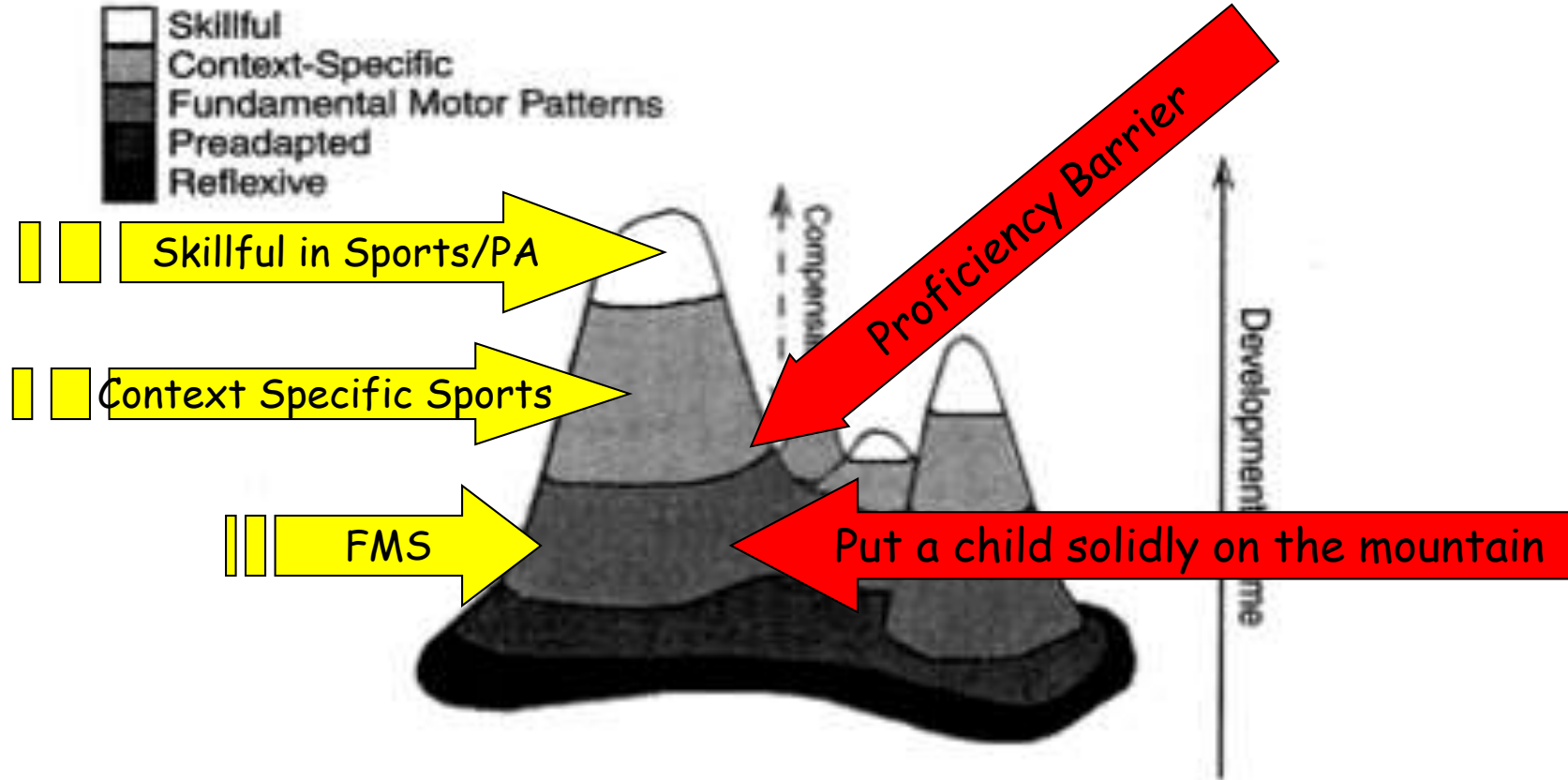
4 Pillars of Physical Literacy

Dudley, Cairney, Wainwright, Kriellaars & Mitchell, 2017





Mountain of Motor Development



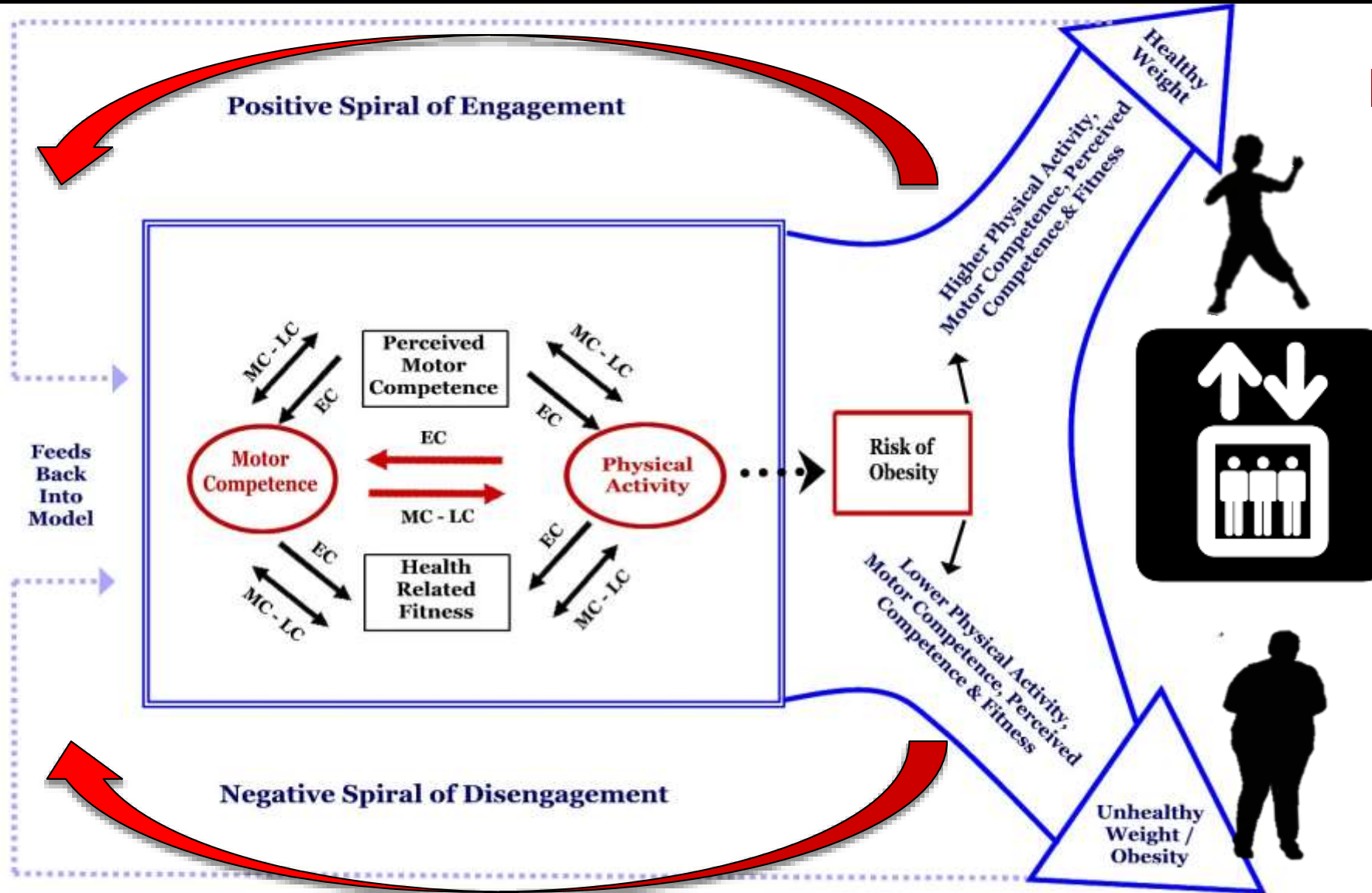
FMS are the “base camp” to the mountain of motor development. Each child needs to develop motor competence for their lifelong physical literacy journey



MC's Role in Influencing the Physical Activity & Obesity Trajectories of Children Elevator Up?.....Elevator Down?

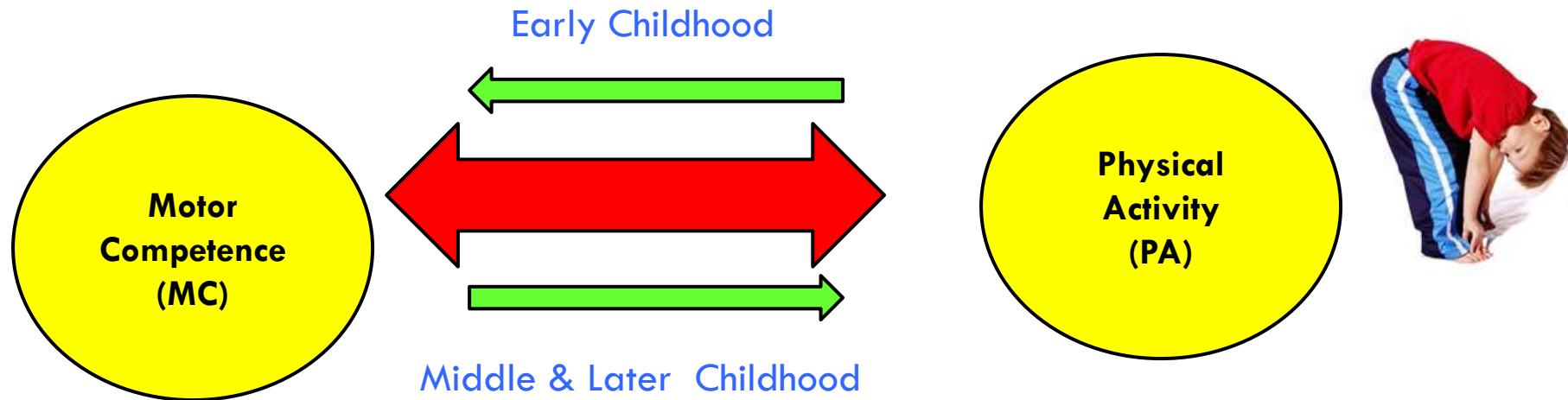


Professor David Stodden





Physical Activity (PA) & Motor Competence (MC)



- **Early Childhood** – Physical activity (PA) opportunities influence the ability to develop motor competence (MC) & are dependent on many contextual variables.
- **Middle/Later Childhood** - MC increasingly determines whether children chose to engage in PA when given the opportunities to do so.
- **Take Home Message – Opportunities to be active in the early years drives development of MC. Moderately to high skilled children will be more active.**
- **We need structured motor skill programs to promote MC in Early Childhood**

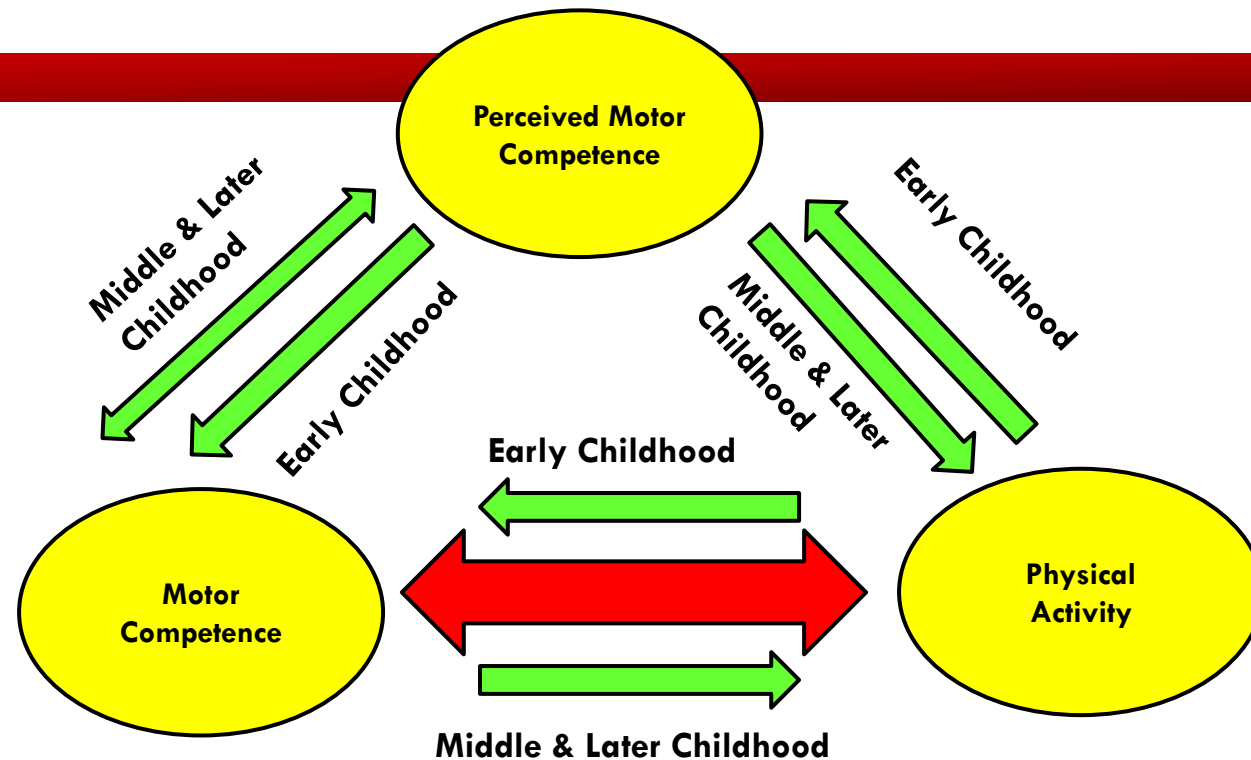


Relationship Between PA, MC & PMC

Early Childhood – children have limited ability to accurately judge PMC.

This can be used as an asset to promote motor acquisition in PE.

Middle Childhood – Children's cognitive capacity changes & PMC & MC more closely align. Children with low MC & low PMC are vulnerable and less active.



Later Childhood – By LCH the interaction between these factors can push children into a negative spiral of disengagement.

Take Home Message

- **Need to promote MC while PMC is high in early childhood & an asset.**
- **Later if MC is low then PMC will fall & PA will also fall = Negative Spiral of Engagement**



Negative Spiral of Disengagement



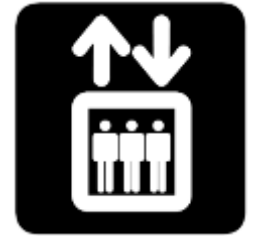
Low MC > opt out of PA > have lower MC

**Less PA influences > less opportunity to practice
> lower MC**

**Over time low MC & PA promotes low
Perceived Motor Competence (PMC)**

**Interaction between PMC & MC results
in lower PA levels & lower fitness levels**

**Inactive & disengaged children with
greater likelihood of overweight &
obesity**





Conclusions from Evidence to Date

- ✓ Robinson et al. (2015) provides a nice overview of the scientific evidence supporting this model.
- ✓ **Early childhood is a critical window of opportunity to develop motor competence while perceived motor competence is high and an asset to instruction.**
- ✓ If actual MC is low then PMC will become low –
- ✓ Recent evidence suggests that children drop out of PA as early as 7 years (Farooq et al., 2017)

POLICY IMPLICATIONS

- ✓ Need to develop FMS during early childhood.





SKIP Program

Successful Kinesthetic Instruction for Preschoolers

- SKIP is a movement program designed to promote early years physical literacy for the early childhood age range (2-8 year olds).
- Theoretically underpinned by dynamic systems theory & Newell's constraints perspective, honoring physical literacy core values.
- **Developed and continually evolving based upon 27+ years of research evidence.**
- Main focus is on intervening with young children who are developmentally delayed in MC, especially those from low socio-economically deprived environments & urban areas





What is SKIP? Use Pedagogical Model

- ❑ **1 - Theoretical foundation** – using a systems approach to instruction
- ❑ **2 - Intended learning outcomes** – SKIP learning outcomes
- ❑ **3 - Developmentally appropriate and sequenced learning activities**
- ❑ **4 - Unique task structures**
- ❑ **5 - Expectations for teacher and student behaviors**
- ❑ **6 - Teacher's content knowledge expertise**
- ❑ **7 - Measures of learning outcomes**
- ❑ **8 – Fidelity - Mechanisms for measuring the faithful implementation of the model itself**



A pedagogical model is a Blue Print for a curriculum that can be flexibly tailored to local conditions.

(Metzler, 2005)

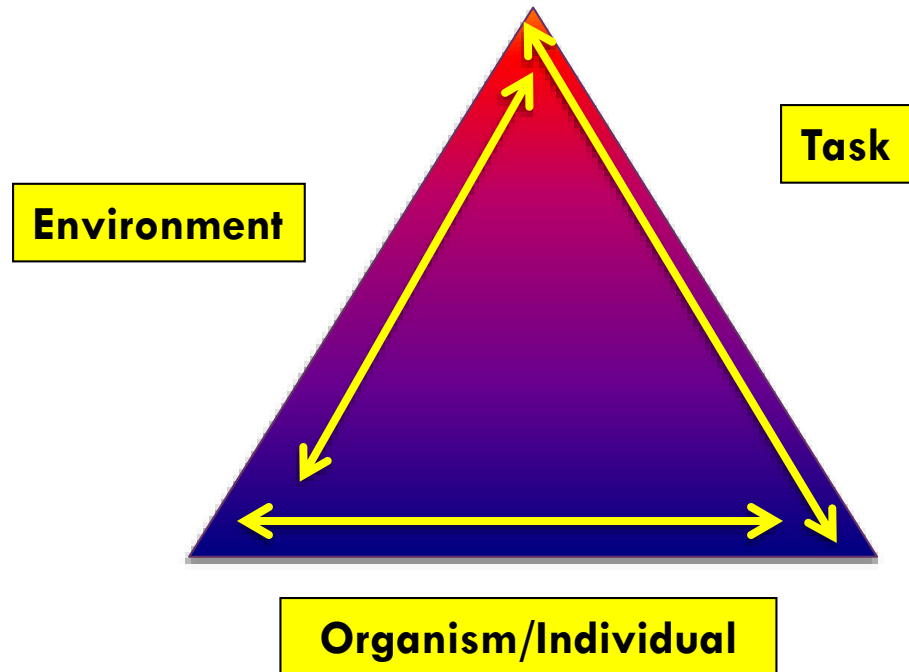


1 - Theoretical Foundations

Newell's Constraints Perspective

- **Dynamic systems theory** recognizes that movement is a product of the interaction between constraints from the child, task & environment. (Newell, 1984, 1986)
- Dynamic theory where movement is embedded & constantly changing
- No end state in movement - environmental factors influence it.

Dr. Karl Newell





Designing SKIP using Constraints

- **1 - All instruction starts from the child**
 - Need to consider the individual constraints that influence the child and his/her performance & accommodate them (e.g. hand-eye coordination).
- **2 - Modify the Environment – Goodness of Fit with Child**
 - Environment consists of factors such as: balls, bats, floor surface, physical prompts such as poly spots, etc.
 - Select equipment that matches the developmental level of the child & accommodates for individual constraints (e.g. large ball with poor tracking)
- **3. Select Developmentally Appropriate Tasks**
 - Based on a child's developmental stage, underlying constraints, and the types of environmental manipulation, select tasks that align with a child's development.





2 - SKIP Learning Outcomes Align with PL

Physical Competence

- Promote movement competence: FMS competence, movement concepts, body awareness, culturally relevant forms of movement
- Learn to move in different environments, different equipment & individuals
- Engage in and increase total PA & MVPA
- Developmentally appropriate health-related fitness

Knowledge & Understanding

- Of the body & it's response to PA
- Of the importance of PA to a healthy body & lifestyle
- Of movement principles
- Learn how to learn





2 - SKIP Learning Outcomes

Motivation, Confidence & Enjoyment

- Improve individual perceptions of motor competence & motivation to be active – choose to be active
- Promote personal-responsible behaviors in activity environments
- Task persistence in a variety of challenging movement contexts

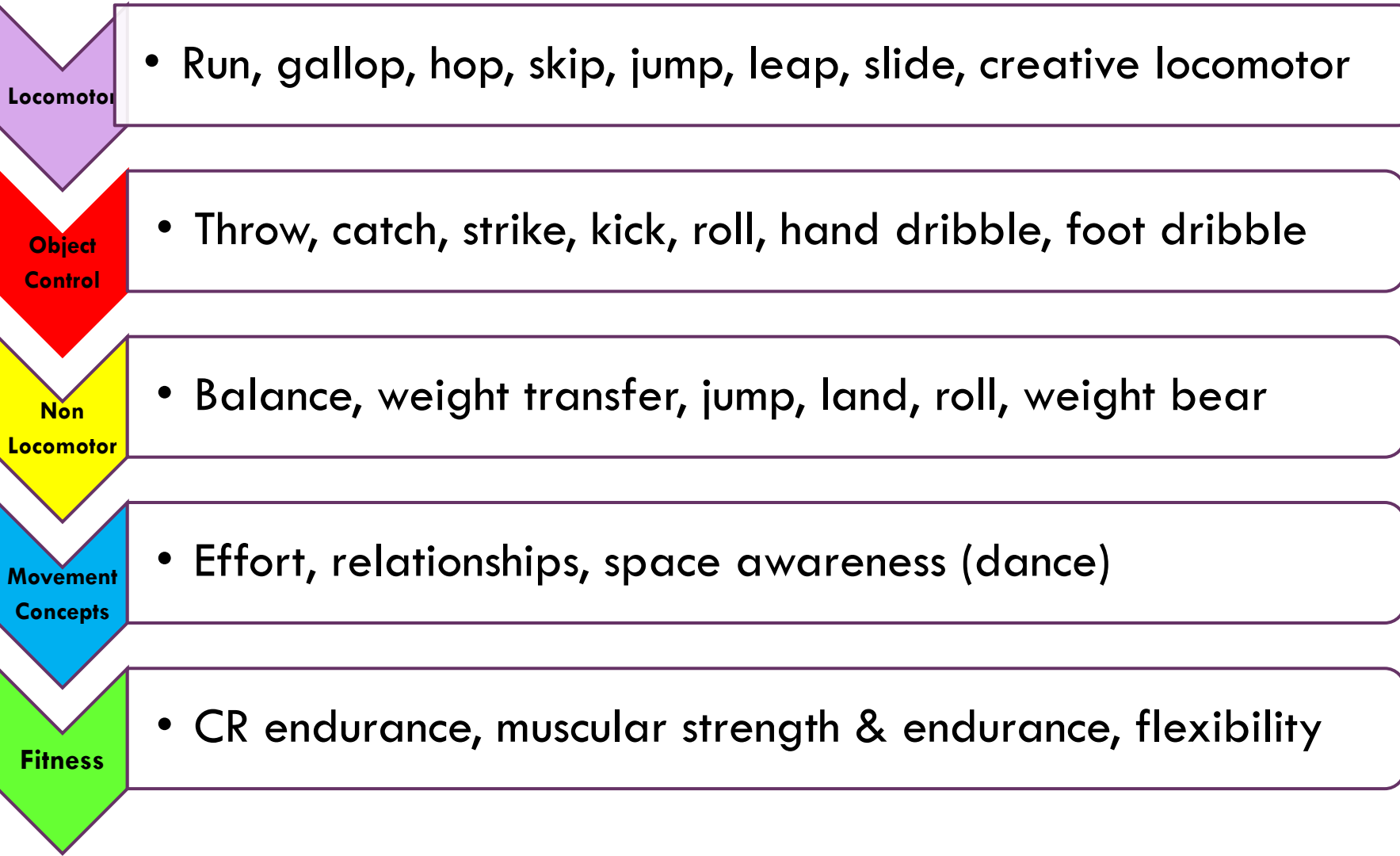
Wrap-Around Engagement in Physical Activities for Life

- Promote at home parent-child activity
- “Camouflage motor skill/physical activities
- Develop an appreciation of an active lifestyle
- Enjoy moving – be a mover – “I am a mover”





SKIP Content Areas



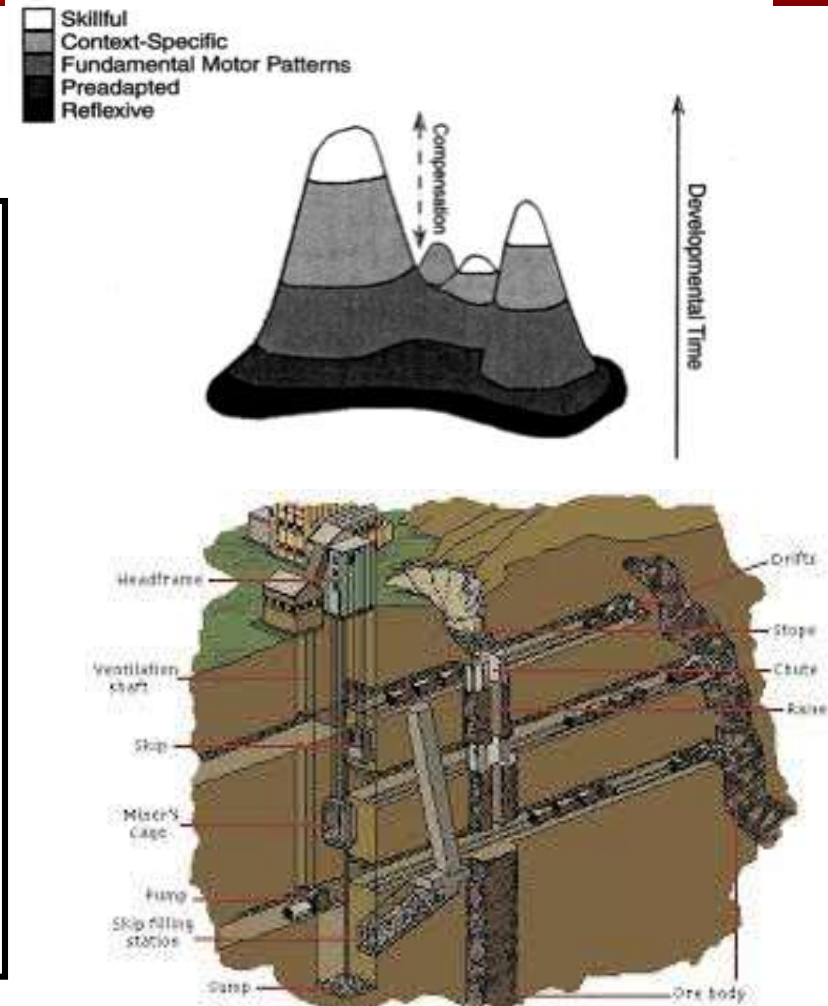


Drilling Down Under the Mountain of Motor Development

EXAMPLES OF CAPACITIES

- Multi-limb coordination
- Control precision
- Reaction time
- Manual dexterity
- Aiming
- Explosive/static strength
- Dynamic strength
- Extent/dynamic flexibility
- Gross body equilibrium
- Balance with/without visual cues
- Speed of limb movement
- Gross body coordination

SKIP develops more than FMS. Below the “surface” of the skill a wide range of capacities are developing that can be applied in all movement environments.





Transfer of Skills to Different Movement Contexts

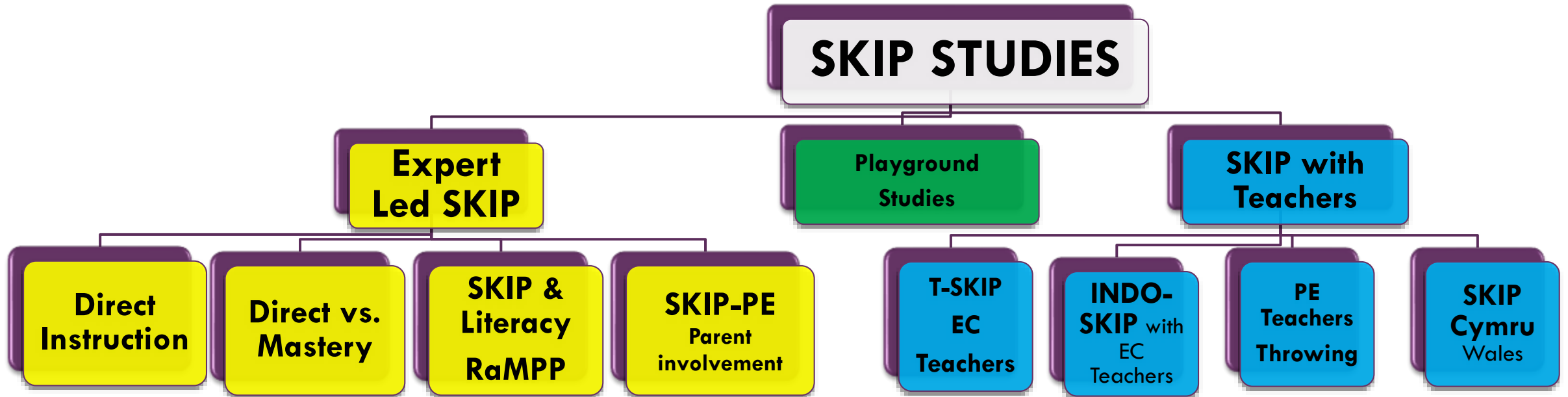


Balance





EVOLUTION OF SKIP





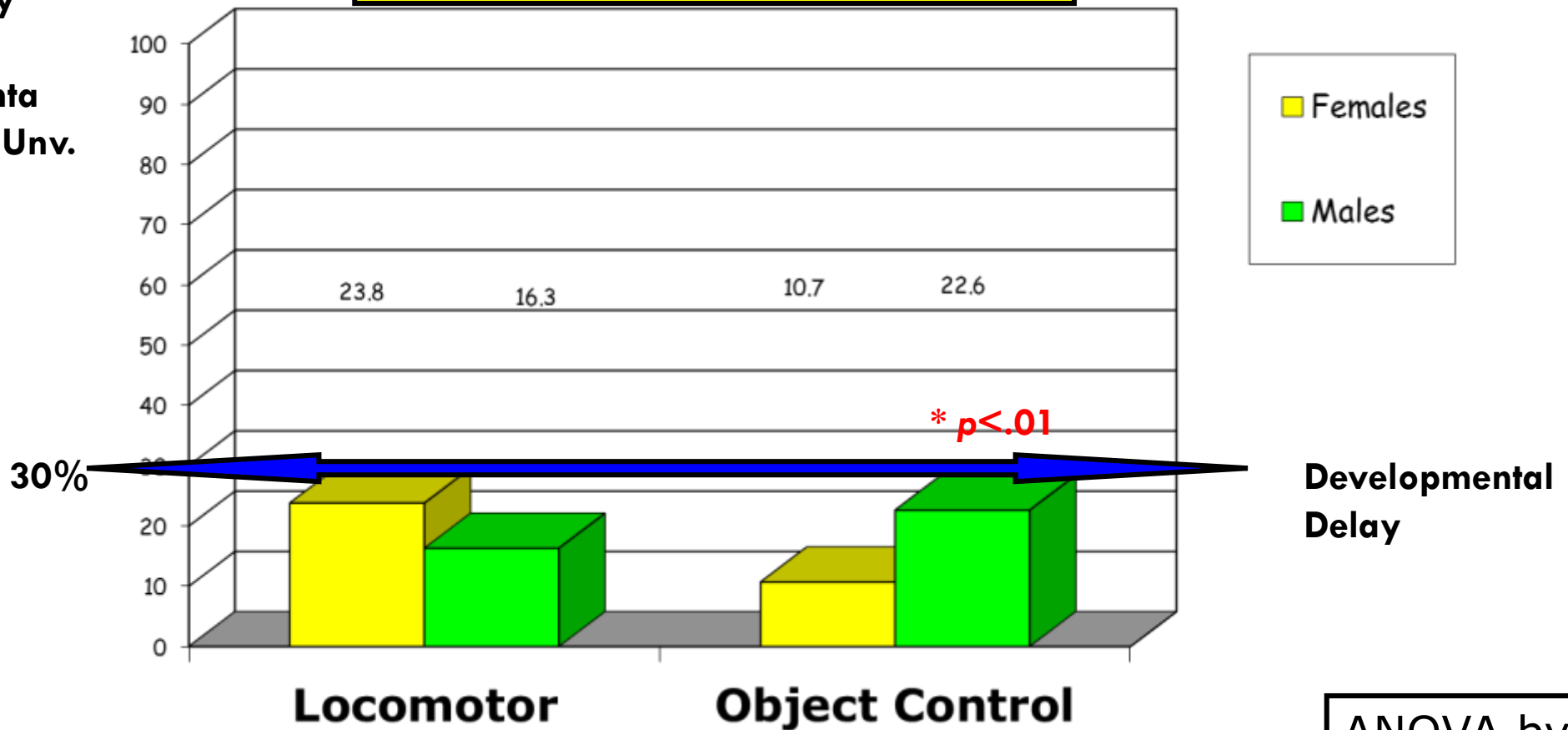
Developmental Delays in MC of Black Children

N=59 African American
Large urban city

Dr. Crystal Branta
Michigan State Univ.



Locomotor – no sig differences
OC – sig gender differences

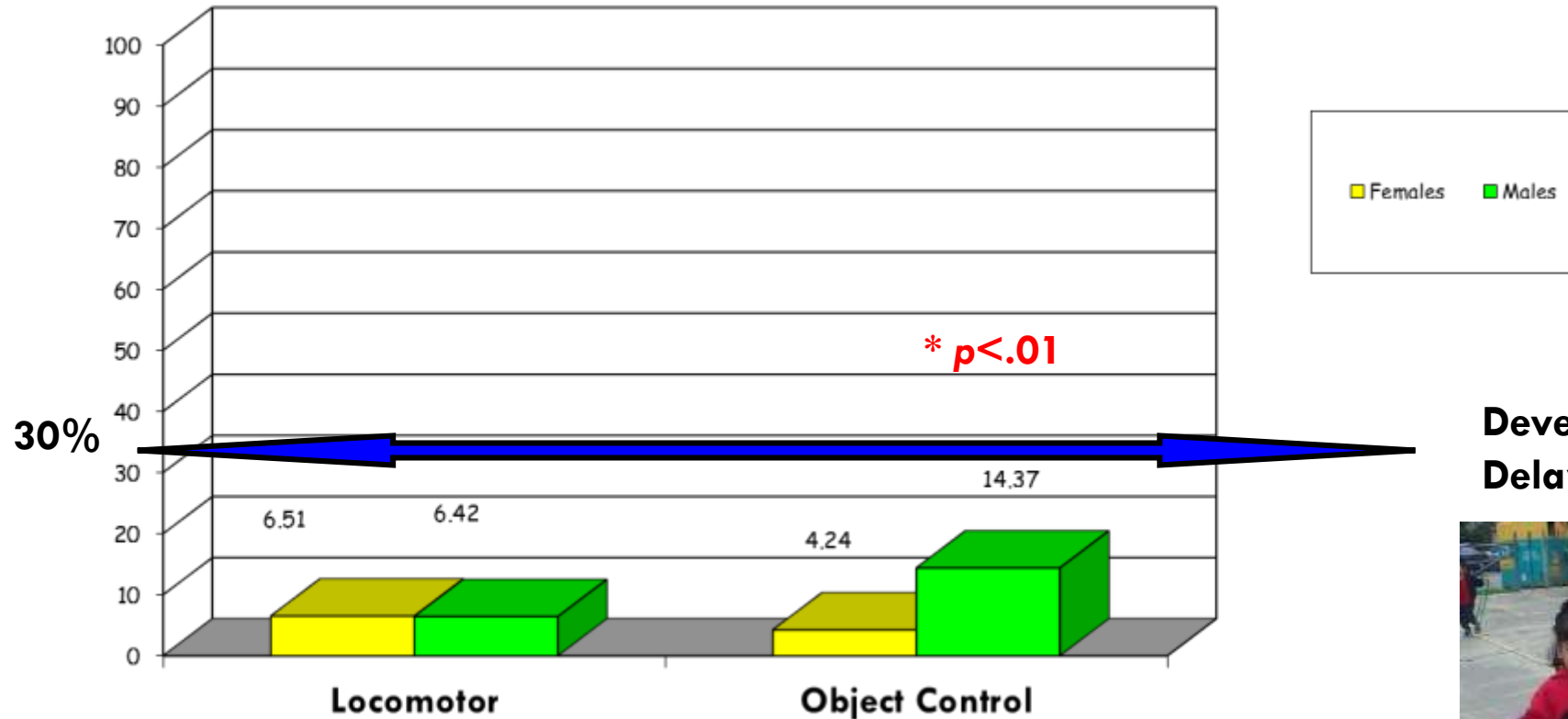


ANOVA by Gender



Developmental Delays in the MC of Hispanic Preschool Children

N=137 Hispanic



Developmental Delay



Goodway, Crowe & Ward, 2003

Locomotor – no differences
OC – gender differences



Consistent Data Across 2 Decades & Many States





Emerging Global Data



Indonesia



Wales



Scotland



Belgium



Turkey



MC Delays in Poor Urban Children

IN THE USA:

- **Outside Environment is not safe** –no where safe to play & develop MC.
- **Inside Environment Sedentary** – promote sedentary behaviors (screen time: TV, gaming, DVD).
- **Poverty** – cannot afford sport opportunities for children.
- **Nature of family dynamics** – Mum working multiple jobs & young children are raising themselves or each other.
- **Parents valued the importance of moving.....BUT....could not make physical activity happen in their environments.**

Goodway & Smith, 2005





Many Children Start & Remain Inactive

- Baby gadgets
- Increased time in buggies
- Screen time
- Lack of active transport
- Busy working parents
- Playgrounds are often empty

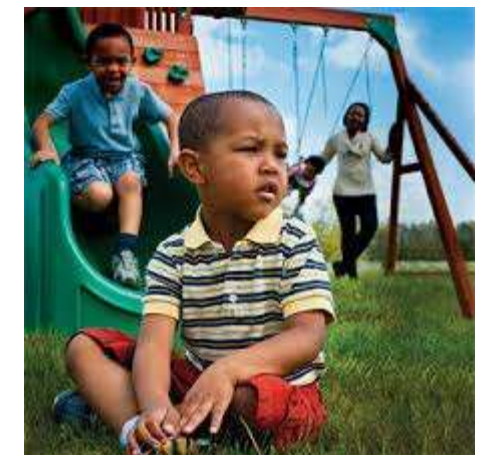




Places Where Our Children Spend the Most Time Do Not Meet the Physical Literacy Needs of Children

Early childhood centers – do not promote MC

- Center policies do not promote MC & PA and often limit movement.
- EC teachers are not prepared in their degree programs to promote MC/PA.
- No suitable gross motor spaces that are developmentally motivating.
- Do not know the data on the importance of PA and MC to overall child development.
- Believe that well-equipped free play leads “naturally” to FMS competence & MVPA on the playground.





Who is Active on the Preschool Playground



Tsuda, Goodway & Famelia, (2017)

- **How active are children on the playground & what role does MC play in accounting for who is active?**
- Children ($N=72$; $M_{age}=4.38$ years, $SD=.85$)
- 42% of time sedentary – only 36% of time in MVPA
- Boys are significantly more active than girls.
- FMS competence (TGMD-2) and perceptions of motor competence significantly ($p<.001$) predicted 43% of the variance in MVPA on playground (after controlling age, sex, and BMI).
- Children who were more motor competent, and had higher perceived motor competence were more active.

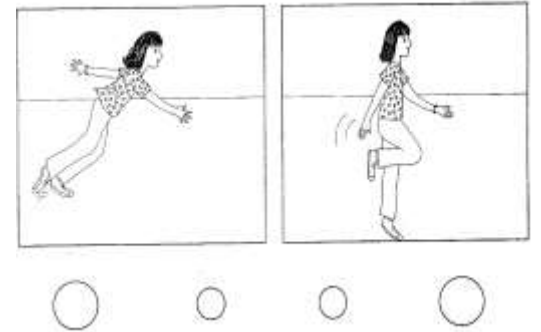


**Improving MC & PMC may
> PA on the playground**



Asset: Perceived Motor Competence

- **Perceived Motor Competence (PMC): The extent to which a child perceives that he/she is competent in an activity – domain specific & developmental.**
- 2 forms of measurement of PMC:
 - Perceived physical competence (Harter & Pike, 1984)
 - Perceived Motor Skill Competence (PMSC) (Barnett et al., 2016)
- **Physical Competence in preschoolers is “pretty good” - 3.28 (SD=.43)** (Goodway & Rudisill, 1997)
- Perceived Motor Skill Competence is “pretty good”
- Problem: Does not align with actual competence.
- Need to use elevated PMC in early childhood years to promote improvements in MC before MC declines.





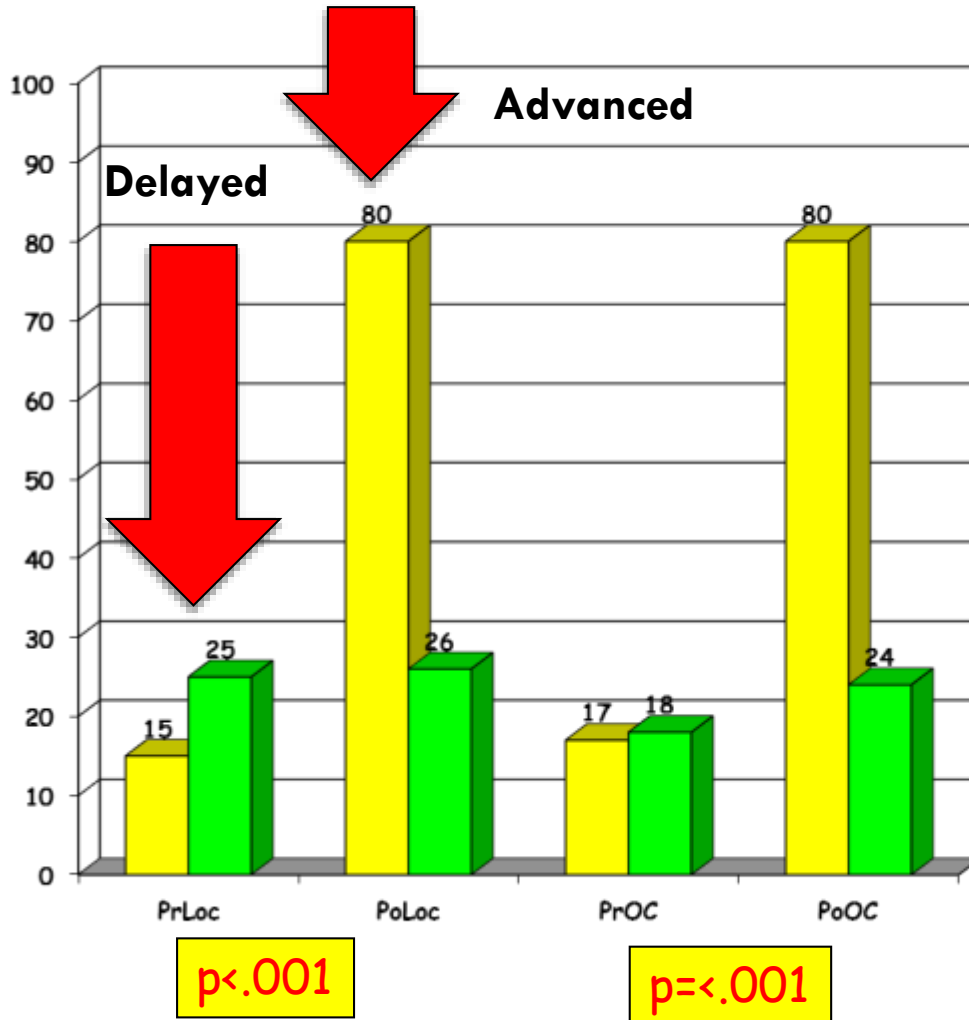
SKIP Expert: Despite Delays: Children Are Resilient with Big Improvements in FMS

Dr. Crystal Branta
Michigan State Univ.



Goodway & Branta (2003)

%



Children who received an Expert Led SKIP intervention improved significantly. Control children did not improve.



12 weeks/ 2 X 45 mins/session – African American preschoolers





SKIP-Significant Improvement in FMS Performance

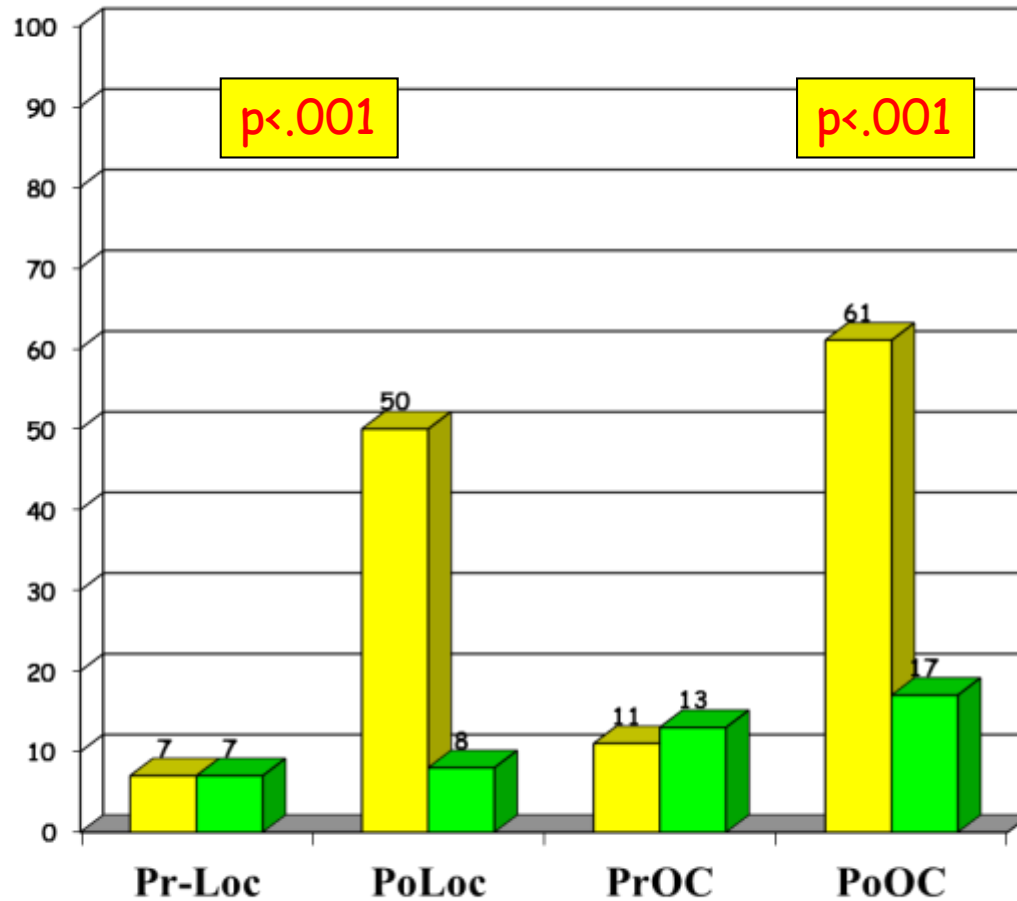
Different Context Culturally – Same Result

9 weeks/ 2 X 30 mins/session

Southwestern Hispanic

N=138

Percentile



SKIP group improved significantly from “delayed” to “typically developing”. Control children did not improve.

■ SKIP
■ Comparison



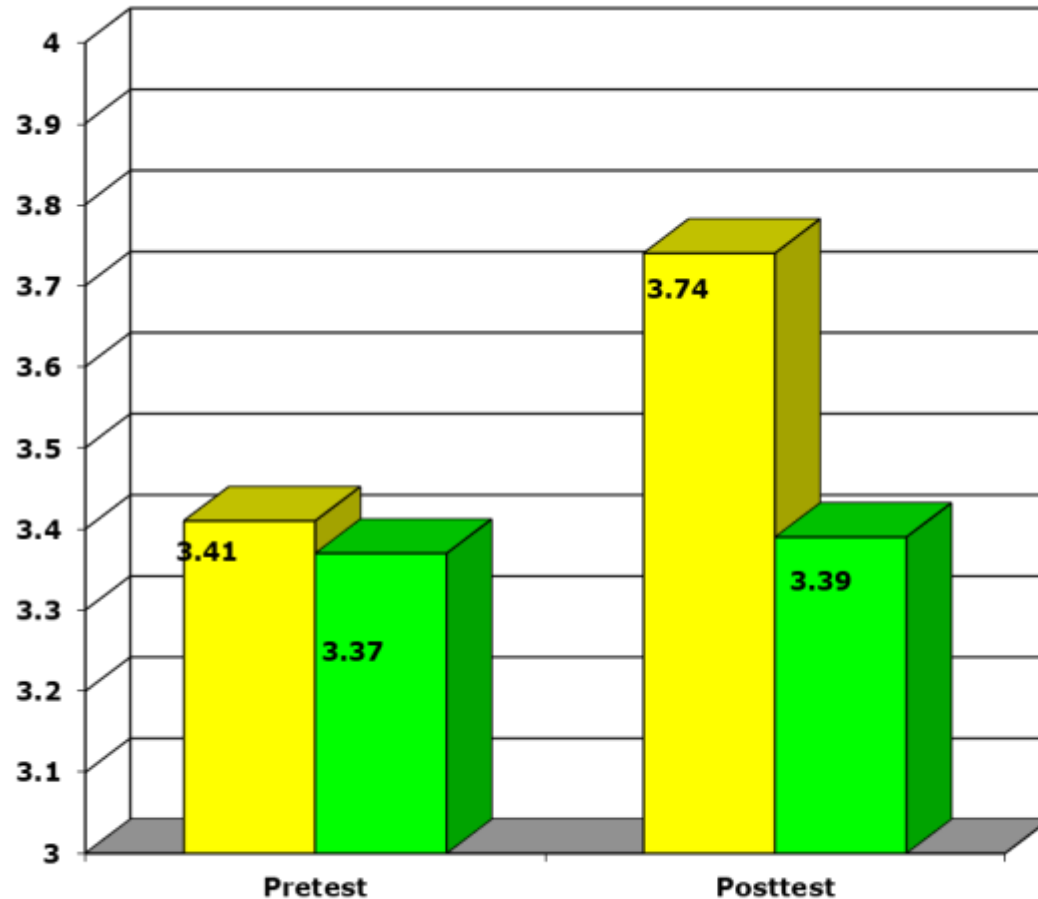


Children “Knew” They Improved Perceived Motor Competence Increased

Dr. Mary Rudisill
Auburn University



(Goodway & Rudisill, 1997)



Not only did FMS improve but also their perceptions of motor competence

■ SKIP
■ Control

Significant Group X Time Interaction



SKIP: Direct & Indirect Pedagogies

LOW ← **Continuum of Autonomy** → HIGH

Teacher Centered-DIRECT

- Teacher Directed
- Array of development tasks provided
- Teacher directs progression through tasks individualizing instruction

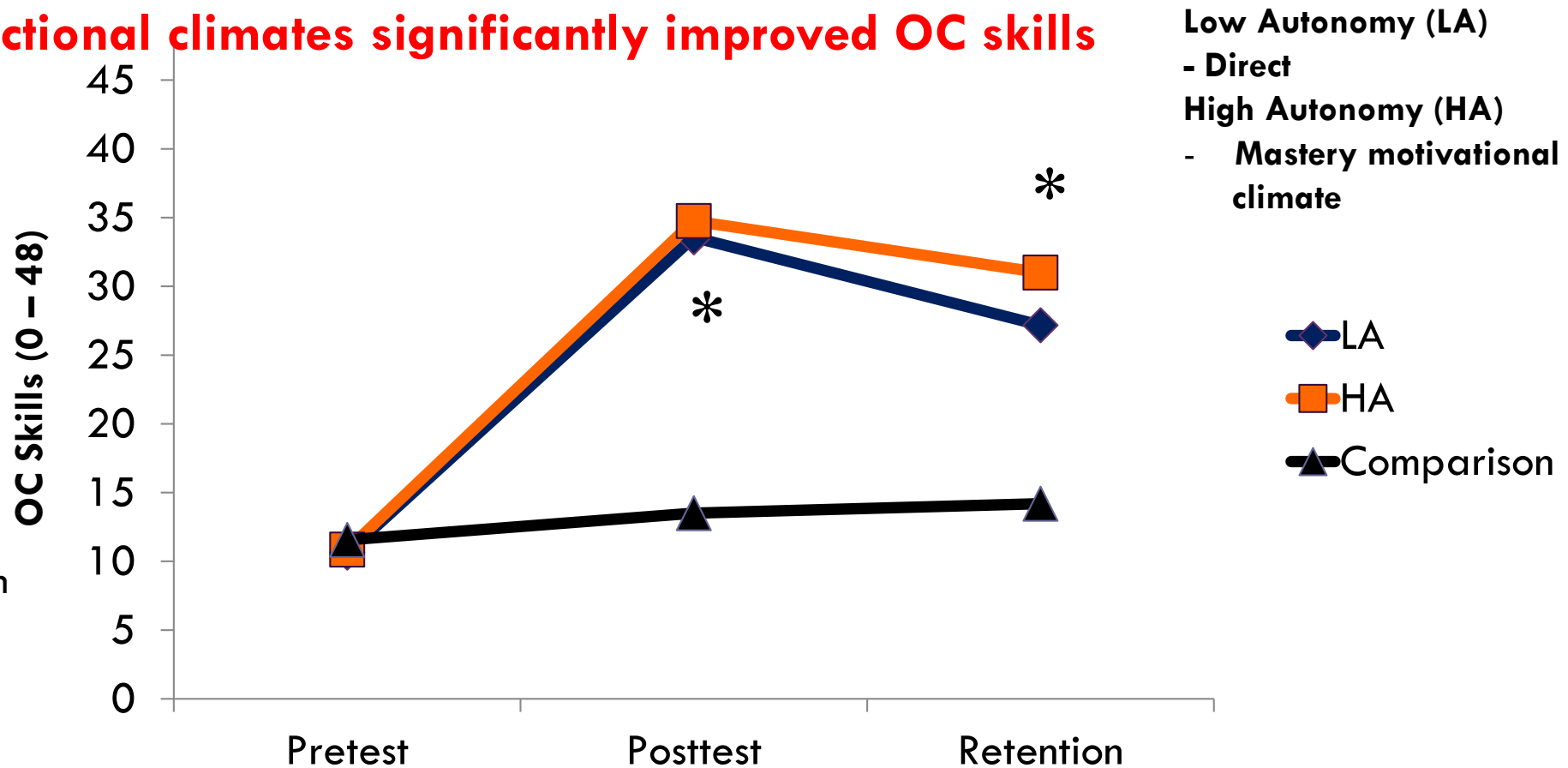
Child Centered-INDIRECT

- Mastery Motivational Climate
- TARGET Structures
 - **T**ask, **A**uthority, **R**ecognition, **G**rouping, **E**valuation, **T**ime
- Same tasks
- Child choices of station, level of task & equipment
- Teacher facilitates



SKIP: Direct Vs. Mastery Instruction

Both instructional climates significantly improved OC skills



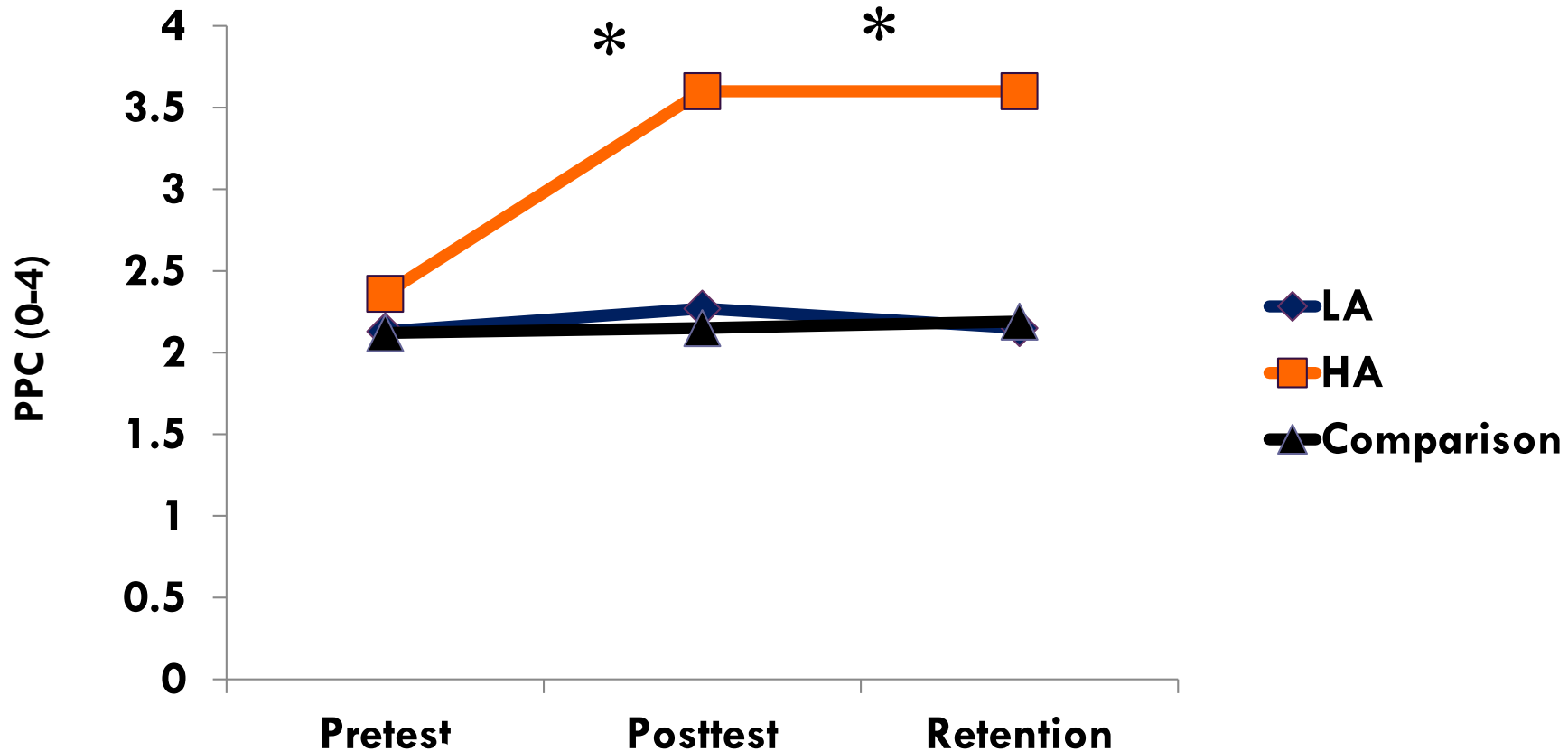
Dr. Leah Robinson
Unv. Michigan





Perceived Physical Competence

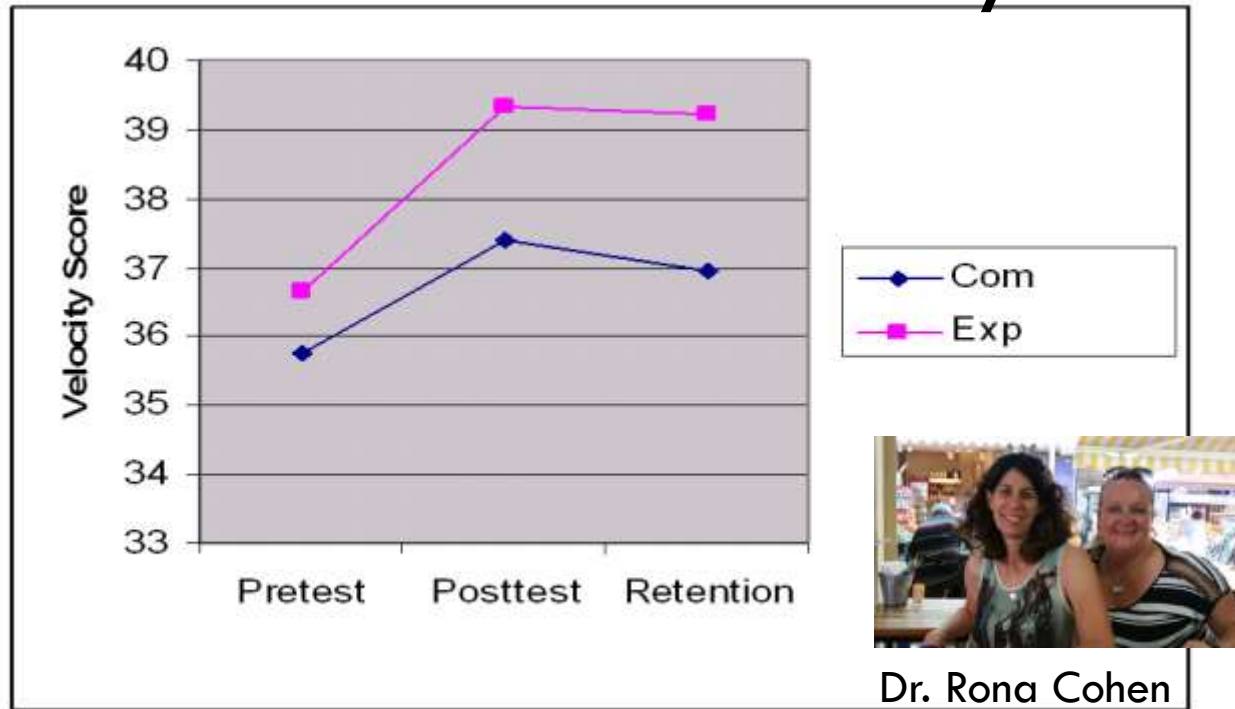
High autonomy climate resulted in greater improvements in PMC





PE Teachers: Aligned Developmental Feedback

Product Measure - Velocity



Males better than females at pretest. Experimental (ADF) group better than Control group pre-to-posttest

- Intervention with PE teachers & 3rd grade students.
- Teachers were their own control
- $n=51$ ADF Experimental group
- $n=51$ Control Group (regular throwing instruction)
- Teachers used developmental sequences to stage a child & aligned feedback to throwing performance in ADF condition.



Aligned Developmental Feedback (ADF)

Process Measure – Body Components

Group	DV	Pre-to-Post	Sig
Comparison G	step	Yes	.001
	trunk	No	.007
	humerus	Yes	.002
	forearm	No	.058
Experimental G	step	Yes	.000
	trunk	No	.024
	humerus	Yes	.000
	forearm	Yes	.002

- Body Components of Throwing:
 - Step, trunk, humerus, forearm
- Males better than females at pretest.
- Experimental (ADF) group better than Control group pre-to-posttest in humerus component.
- May account for increased velocity.
- Trunk was hard to change to a rotating trunk.



Expert-Led SKIP Conclusions

- ✓ Expert-led SKIP could bring about improvements in FMS.
- ✓ Well-equipped free play – “flat liners” – no changes in FMS.
- ✓ Motor development experts & PE Teachers could implement the SKIP approach effectively in a variety of contexts (preschools, schools).
- ✓ **Limitation** - in preschools & some elementary schools experts are not present.





SKIPing with Early Childhood Teachers

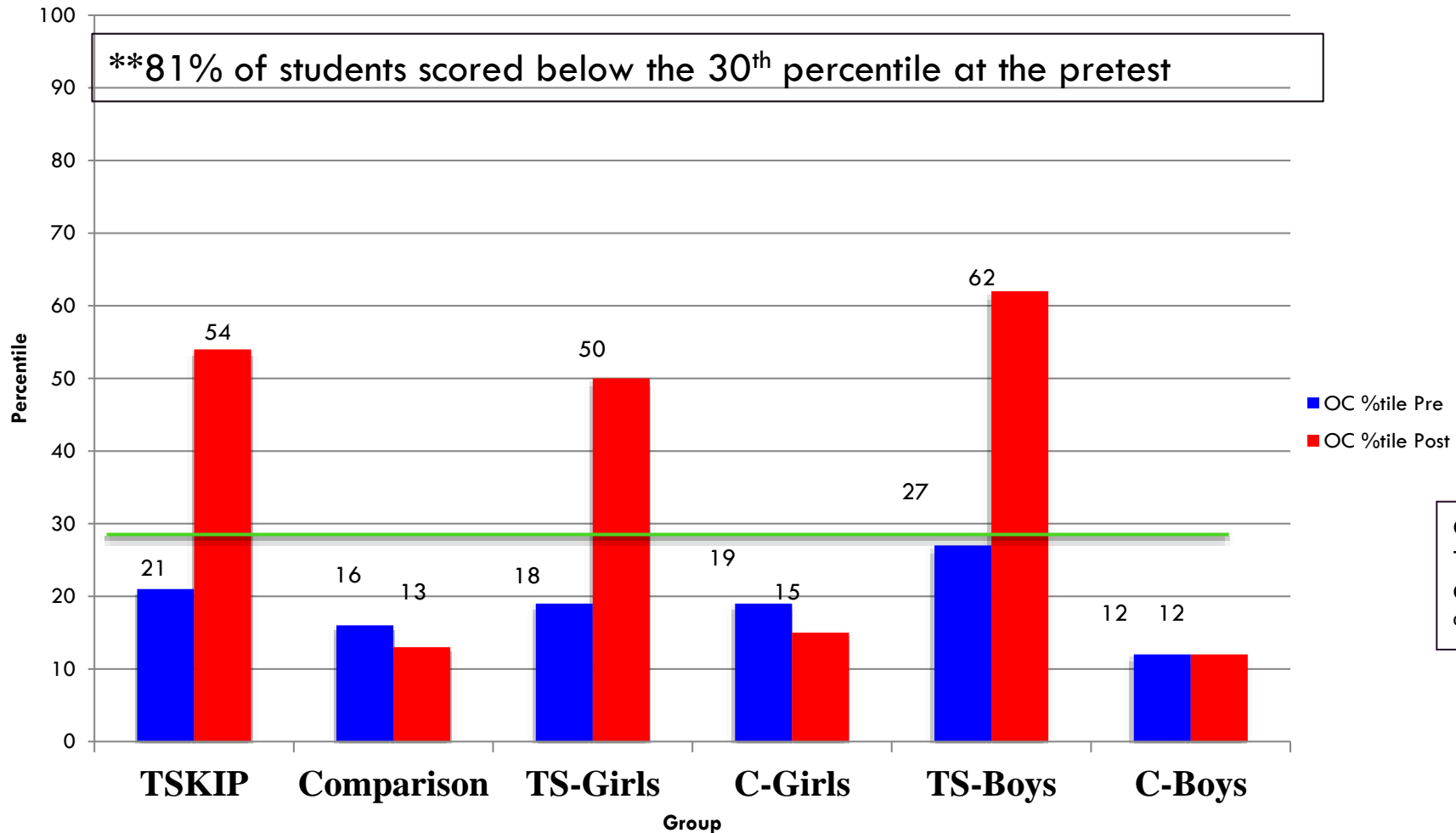
- ✓ **Training Early Childhood Teachers to deliver SKIP**
 - ✓ Developmental sequences
 - ✓ Task and environmental constraints of fundamental motor skills
 - ✓ Correct demonstrations – some Teachers were delayed in FMS
 - ✓ Task sequences for skills from simple to more complex tasks & sample lesson plans.
 - ✓ Challenge activities to check for understanding
 - ✓ Fidelity measures collected





SKIP Delivered by Teachers (T-SKIP) Significantly Improved OC Skills

OC Mean Percentile Ranks



Dr. Ali Brian
Unv. South Carolina





What are the effects of T-SKIP on OC scores? Hierarchical Linear Model (HLM)

Parameter	Coefficient	SE	T	df	p
Comparison	5.66	.48	11.81	8	.000
T-SKIP	4.70	.67	7.02	8	.000*
Pretest	.50	.14	3.44	9	.007*

10.36

* $p < .05$

The T-SKIP group outperformed the Comparison group

Intraclass Correlation Coefficient (ICC) = 30% - variance attributed to teachers



Could Teachers Implement T-SKIP with Fidelity?

- Lesson play fidelity measured from video of each lesson
- **Level-1 Core element=59%**
- Level-2 Highly desired=34%
- Overall Fidelity Mean=47%
- Compared to an expert, the early childhood teachers could only deliver SKIP with less than 50% fidelity.





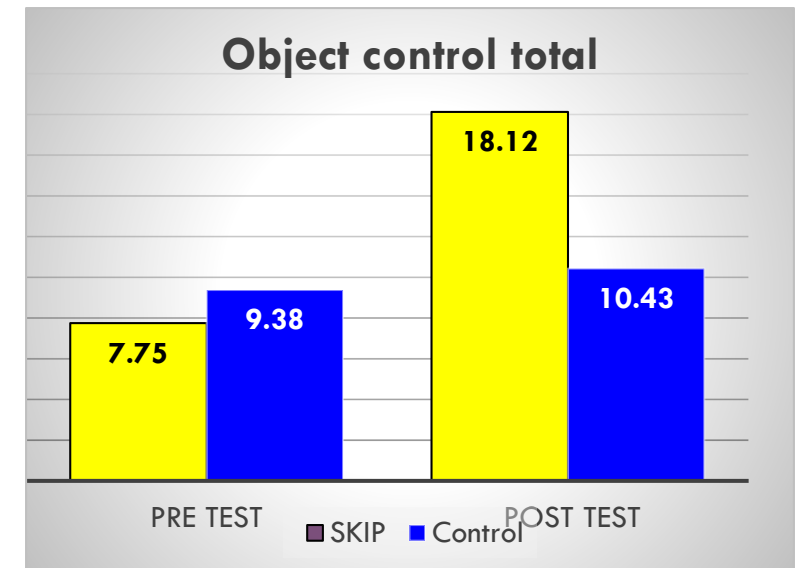
SKIP Cymru – Wales

Policy Work - Elementary Teachers



Dr. Nalda Wainwright

- ✓ **Teachers in Wales could bring about significant improvements in OC skills & PMC using SKIP-Cymru.**
- ✓ Trained over 300 teachers in Wales in SKIP-Cymru.
- ✓ Cascade effect of SKIP-Cymru:
 - ✓ Train 2-3 teachers in a school, more teachers came to next training.
 - ✓ In some cases the Head Mistress of the school trained all teachers due to powerful impact of SKIP-Cymru on child outcomes.
- ✓ Teacher's built SKIP into their academic content lessons so children moved throughout the day.
- ✓ Overall change in school-wide physical literacy. Teachers value the child outcomes of SKIP-Cymru.

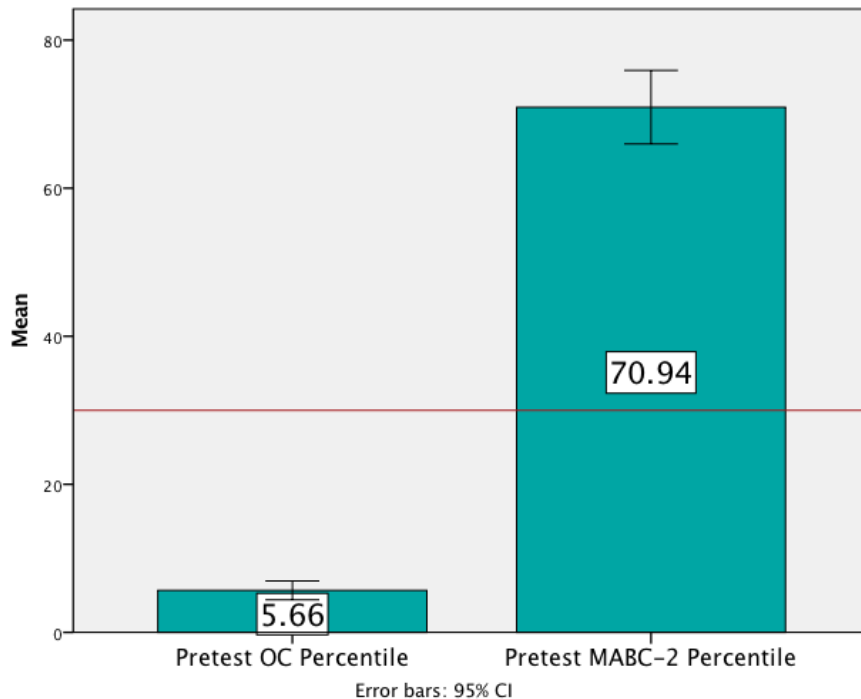




INDO-SKIP – Indonesia - Pretest

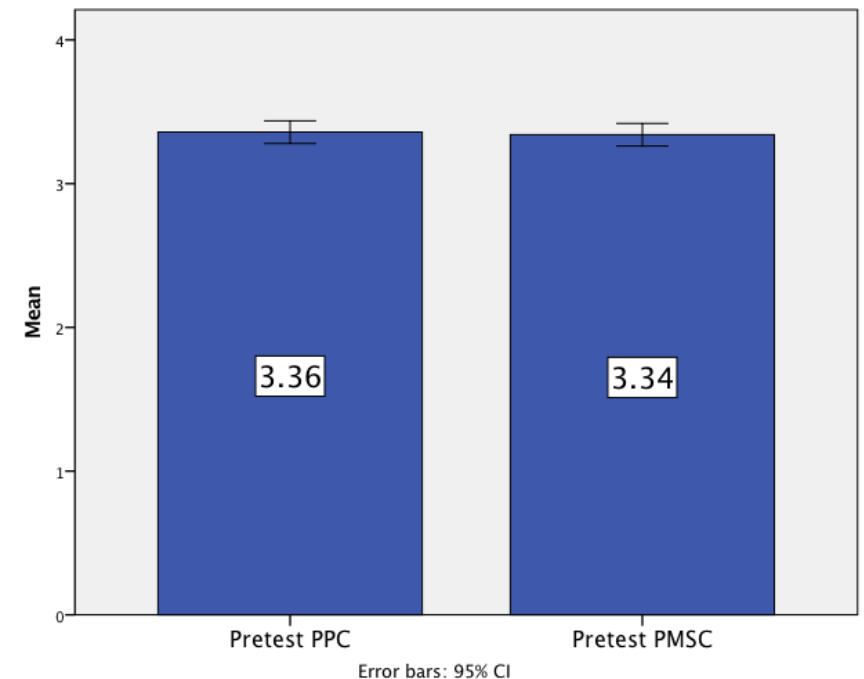


Motor Competence Percentile



Dr. Ruri Famelia

Perceived Motor Competence



- 97% of participants were delayed in **OC skills**
- 15.8% of participants were delayed in MABC-2

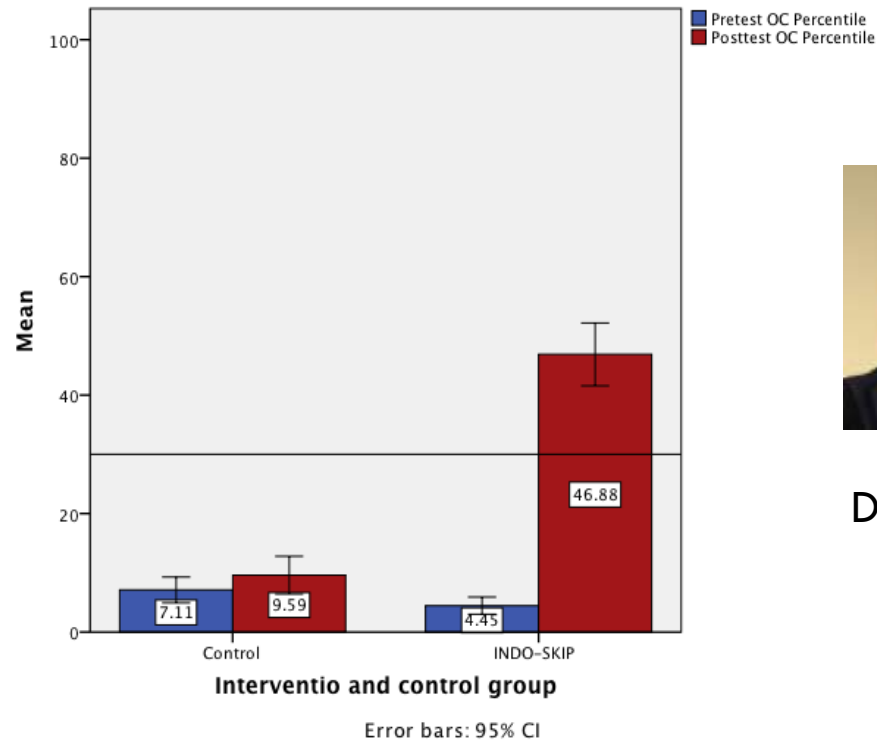
- Participants perceived themselves as **“pretty good”** on both PPC and PMSC.



INDO-SKIP – Pre-Posttest

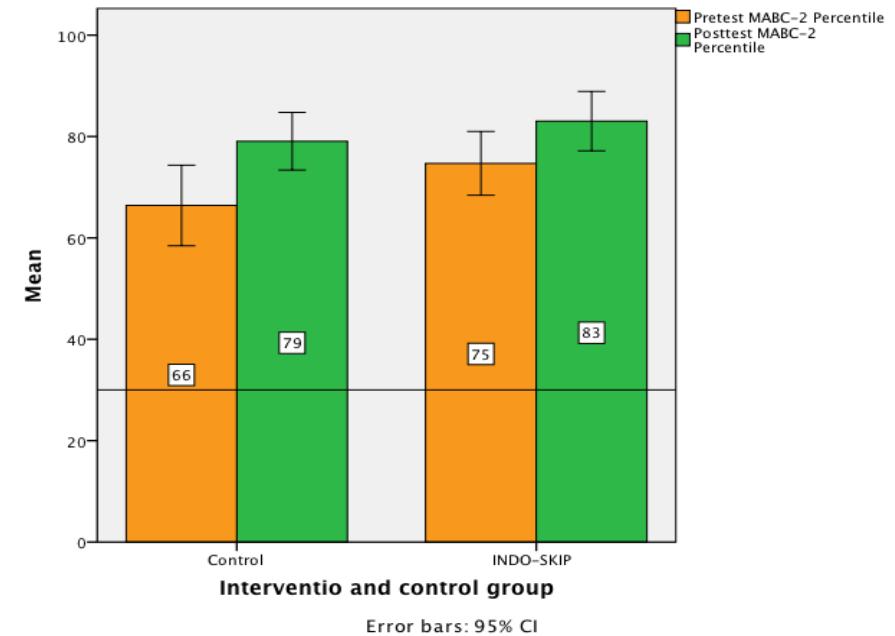


TGMD-2 – OC SKILLS



Dr. Ruri Famelia

MABC-2



- INDO-SKIP group: **significantly higher posttest OC raw scores** ($p < .001$) when accounting for pretest scores.
- **Large effect size** ($\eta^2 = .55$, Cohens' $d = 2.21$).

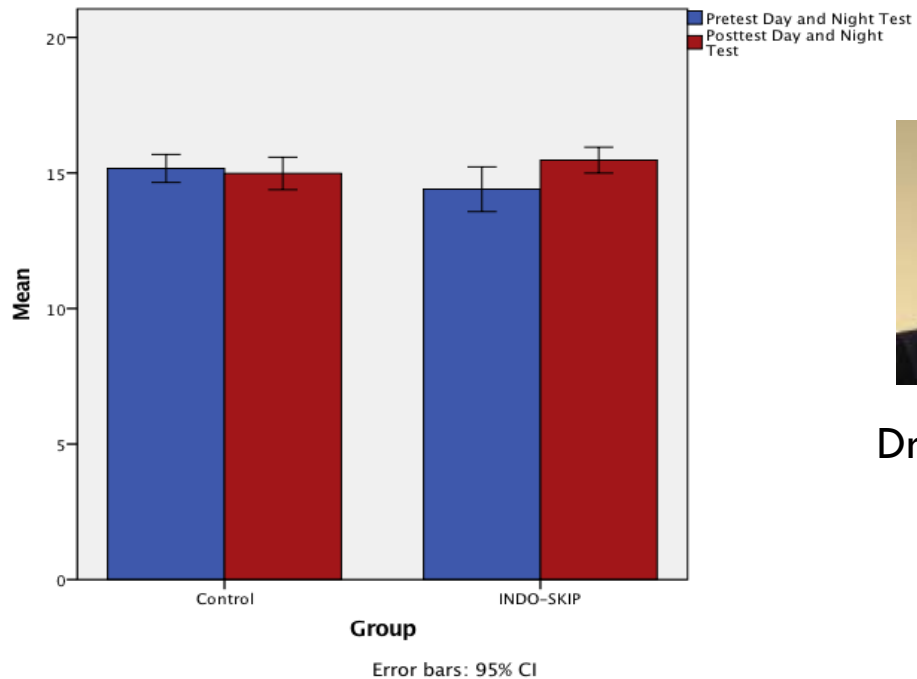
- **No significant group differences in posttest MABC2 raw scores** ($p = .07$) when accounting for pretest OC raw scores



INDO-SKIP – Executive Function



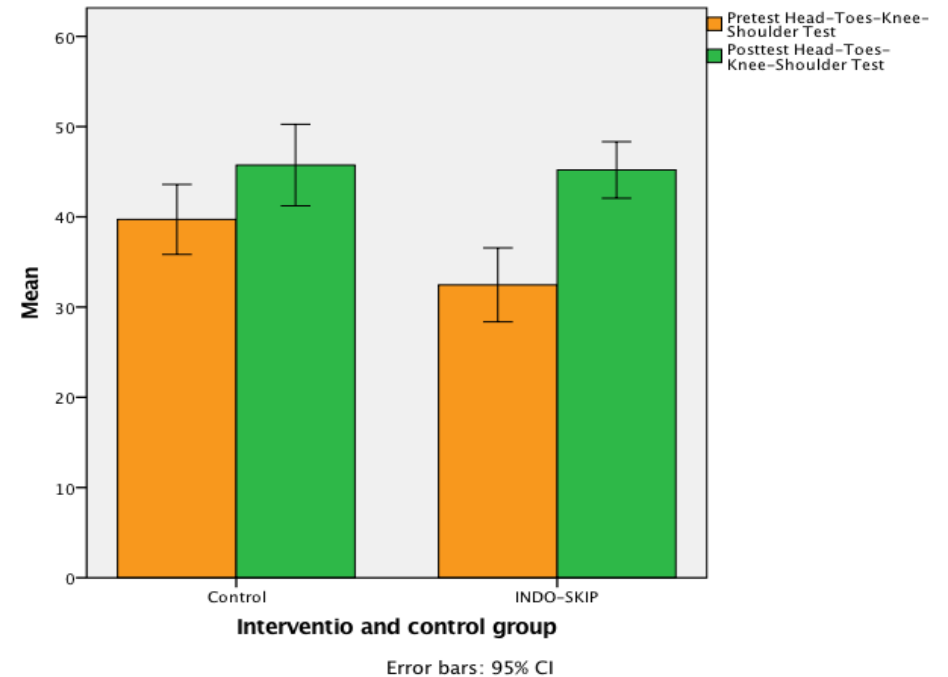
Day-Night Test – Inhibitory Control



Dr. Ruri Famelia

- INDO-SKIP group significantly higher posttest Day Night scores than the Control group ($p < .01$) when accounting for pretest scores.

Head-Toes-Knees-Shoulders Test Behavioral Self Regulation



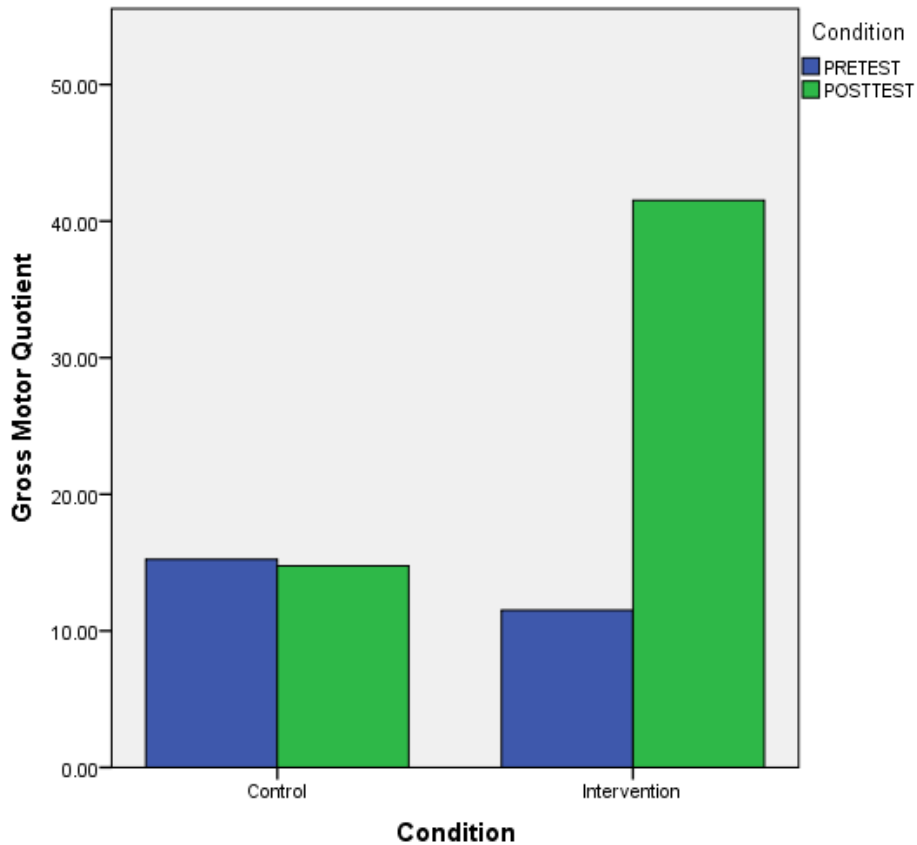
- No significant group differences in HTKS test. ($p = .39$).



Reading & Motor Program - RaMPP



Motor skills & reading literacy integrated



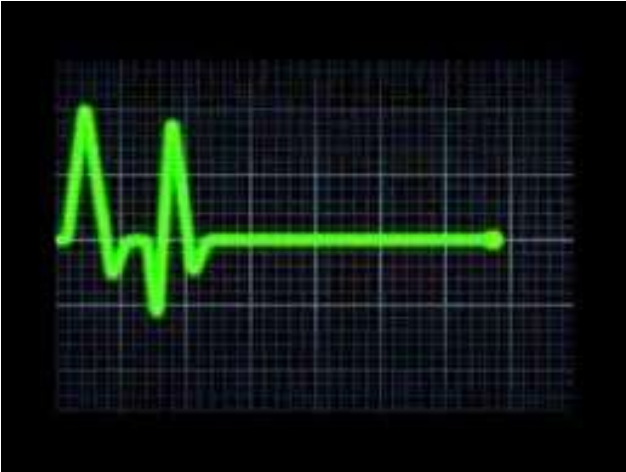
Dr. Tricia Biancone



- Children in the RaMPP group significantly ($p < .001$) better than Comparison group on OC skills.
- Children in the RaMPP group significantly better at literacy skills (lower case letters & initial sounds) than Control group.



Typical Preschool Practice – “Flat Liners”



- Remain developmentally delayed in FMS
- Greater risk for:
 - Negative Spiral of Disengagement
 - Sedentary behaviors
 - Likelihood to be overweight





Evidenced-Based Recommendations

- Children from deprived environments are developmentally delayed in FMS & in need of motor skill programs like SKIP.
- As little as 360 mins of SKIP brings about significant improvements in:
 - FMS skills, Perceived Motor Competence, Executive Function.
- Higher dose of SKIP results in stronger effect sizes.
- Well equipped free play does not result in improvements to FMS or PMC.
- Experts and Early Childhood Teachers with Training can deliver SKIP successfully.
- Use a developmental, constraints approach to teaching - individualized.
- SKIP can be integrated with other academic areas to promote literacy and executive function outcomes.



SKIP Conclusions

Dudley, Cairney, Wainwright, Kriellaars & Mitchell, 2017

4 Pillars of Physical Literacy

Effective PL Policy for Sport,
Physical Education, & Public Health

MC is
critical &
needs to be
developed
in early
childhood

Motor
Competencies

For many
children
their
context does
not support
MC & we
need to find
places to
intervene

Movement
Contexts

We need
to start
children on
their
PL
journey
early

Journey of
Movement

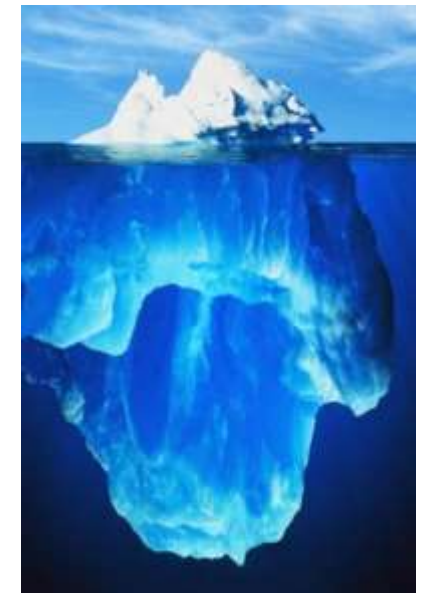
There are
disparities
in movement
opportunities
for children

Power
Structures of
Movement



Future Research Implications

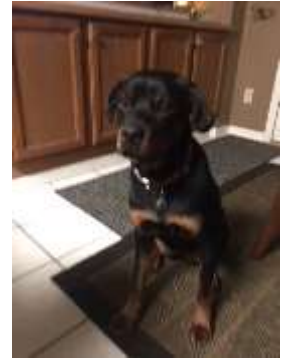
- **Assessment Struggles** (analogy of an iceberg):
 - “Capturing” changes in overall PL as a result of SKIP, especially embodiment (wholistic concept). We don’t “capture” the refinement in skills that we see from the instruments we use. E.g Better kinesthetic awareness.
 - Under the mountain – measuring what is changing below the level of the skill (e.g. balance, hand-eye coordination, tracking...)
- **Longitudinal Study:** if we “bump” them early, do children “stay” on the mountain and continue to develop their PL and be more active?
- **Proficiency Barrier** – how much MC and PMC is enough for spiral of engagement and positive trajectories?
- ❑ **Export Home** - Tracking how children “export” their knowledge & motivation to home environments & impact on family.
- ❑ **Principles for Teacher Training** – tailor to local conditions.





Acknowledgements

- My research team at Ohio State University.
- Many wonderful doctoral students across the years.
- My collaborators.
- The amazingly resilient families and children with whom I am privileged to work.
- Funding: National Institute of Health R21HD055621-01A2



My newly formed family

תודה

