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Research Article

Examination of the Relationship between Existing Playground Designs and Children's Fundamental Movement Skills

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Abstract

A limited number of children receive proper physical education between the ages of 0-6 which is the main period for children to learn fundamental movement skills (FMS). In contrast to physical education opportunities, most of the children have access to neighborhood playgrounds. Proper interventions and improvements to playground designs may be the easiest and most efficient way to provide for many children to develop the FMS they need to acquire in their early years. This study aims to investigate the efficiency of the existing playground equipment and to provide an answer to the question regarding the qualification of existing playgrounds in terms of children's FMS. The method of this study consists of three main steps; the first step is to analyze the commonly used assessment tools for FMS development to generate a list of mostly assessed movement skills. The second step is to inspect the mostly preferred playgrounds in the study area and analyze every piece of equipment they have, and finally to correlate the results from the first two steps. The results reached in the study were evaluated based on the level of competence gained by playground designs in terms of providing opportunities for necessary physical movements and their support rates for basic movements. It is thought that the interpretation of the study results will provide insight and a detailed guide in the early stages of the design process for future playground designs.

Keywords: Child Development, Physical Development, Fundamental Movement Skills, Playground Equipment, Playground Design

Mevcut Oyun Alanı Tasarımları ile Çocukların Temel Hareket Becerileri Arasındaki İlişkinin İncelenmesi

Öz

Çocuklarda Temel Hareket Becerilerinin (FMS) öğrenimi için ana dönem olan 0-6 yaşları arasında ancak sınırlı sayıda çocuk uygun beden eğitimi almaktadır. Beden eğitimi fırsatlarının aksine, çocukların birçoğunun mahalle oyun alanlarına erişim imkânı vardır. Oyun alanı tasarımlarında yapılacak uygun iyileştirmeler ve müdahaleler, birçok çocuğun erken yaşlarda edinmeleri gereken FMS'yi geliştirmelerini sağlamanın en kolay ve en etkili yolu olabilir. Bu çalışma, mevcut oyun alanı ekipmanlarının çocukların FMS üzerindeki etkinliğini araştırmayı amaçlamaktadır. Bu çalışmanın yöntemi şu üç ana adımdan oluşmaktadır: İlk adım, FMS gelişimi için en yaygın olarak kullanılan değerlendirme araçlarını analiz etmektir. İkinci adım, mevcut araştırma bölgesinde en çok tercih edilen oyun alanlarını incelemek ve bu alanlarda bulunan her bir ekipmanı analiz etmektir. Son adım, ilk iki adımdan elde edilecek sonuçları birbiriyle ilişkilendirmektir. Araştırma sonuçlarına göre, mevcut oyun alanlarındaki ekipman tasarımları, temel hareketlerin çoğunu doğrudan desteklenmediği için, gerekli fiziksel hareketler için fırsatlar sağlama açısından ancak sınırlı bir yeterlilik düzeyindedir. Bu çalışma, mevcut oyun alanlarının, çocukların FMS açısından yeterliliği ile ilgili soruyu cevaplamaktadır. Gelecekteki oyun alanı tasarımları için ayrıntılı tasarım yönergeleri geliştirilebilmesi adına daha ileri çalışmaların yapılması gerekmektedir.

Anahtar Kelimeler: Çocuk Gelişimi, Fiziksel Gelişim, Temel Hareket Becerileri, Oyun Alanı Ekiplanları, Oyun Alanı Tasarımı

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1. Introduction

Fundamental Movement Skills (FMS) is an important area of study approached by researchers in a variety of fields. There are several studies in child development literature about the importance of FMS, the ways of improving these skills, and the assessment of these skills. FMS development has many different positive effects on children. Different studies show that physical activity and FMS have many beneficial effects on children's motor development (Duman et al., 2019), social and emotional development (Brown & Cairney, 2020; L. Eddy et al., 2021; Rodriguez et al., 2019), sports-specific skills (Poest et al., 1990), and brain development (Meijer et al., 2020).

Fundamental movement skills are basic movement patterns that begin developing when a child can walk independently and move freely through his or her environment (Goodway et al., 2019). In addition to that, preschool years are where kids' FMS evolve (Toussaint et al., 2020). However, FMS development is mostly applied in school settings. For the mentioned reasons, it seems to be a waste of potential to wait until a child starts school to start actively developing FMS considering that, not all children have access to preschool at an early age and not all preschool curricula involve structured FMS education.

There are also studies focusing on physical development outside of the school setting. Some of these studies point out the importance of playgrounds and the time spent in playgrounds in terms of the physical development of children. However, there is a major misconception about the development of FMS which is the belief that they are only determined by maturation (Goodway et al., 2019) On the contrary, children's performance in these skills will only increase if they engage in structured practices continuously (Seefeldt, 2013). Even if they develop these skills on their own up until some point, providing kids with the right opportunities increases their performance of development (Duman et al., 2019).

The idea of creating neighborhood playgrounds that support FMS in every aspect could be an efficient way to provide children with these skills in natural settings. When successfully applied, this approach can be a long-term, socially inclusive, and feasible solution to children's developmental needs on FMS.

Even though there are plenty of studies on the relationship between playgrounds and children's physical activity, the number of studies that focus on both FMS and playgrounds is very limited. So, this study aims to investigate the relationship between existing neighborhood playground equipment and children's FMS development to explore the usefulness of such kind of approach to FMS development and to create a reference point for future intervention on playgrounds and new playground designs.

2. Material and Method

2.1. Method

This study is conducted in 3 main steps. The first step is to identify what kinds of FMS are expected for a child to master before they reach adolescence and how relevant body parts get involved in the movements associated with these skills. The second step is to determine the types of equipment that are currently being used in the neighborhood playgrounds and analyze their movement values. The last step is to relate the outcomes from the analysis of the first two steps.

2.1.1. Determination of FMS

The focus of the literature search in the study was to determine valid FMS assessment tools and extract data from them to come up with a list of movements that are commonly assessed in children and expected to be mastered in childhood. Eddy et al.'s study (2020) gives us the necessary knowledge about existing observational FMS assessment tools and their psychometric validity. In the study, 24 assessment tools were found to be studied in the literature in terms of their reliability. The authors also identified all the FMS assessed with each tool and conducted a systematic review. In the conclusion section, the writers discuss the validity and reliability of the tools and none of the assessment tools were stated as completely reliable or unreliable. As a result, for this study, all the FSM assessment tools and the movements that were assessed in these tools (n=31) were accepted as FMS that are expected to be acquired by children. This inclusive approach was adopted to include all possible FMS in the study. A detailed list of the tools can be found in the original study (L. H. Eddy et al., 2020).

2.1.2. Analysis of FMS

All the FMS mentioned in one or more of the assessment tools were listed along with the percentage of the assessment tools with which they were assessed, and the active body parts in motion when performing that movement.

2.1.3. Playground Selection

This study was conducted in Dallas-Fort Worth Metropolitan Area and used purposeful sampling as the sampling method. To analyze the neighborhood playgrounds that are preferred and visited the most by the residents of the area, data from Google Reviews was used. 10 playgrounds or parks that have playgrounds with more than 1000 reviews and 4.5 review points were randomly selected and visited. 2 of the visited playgrounds (PG3 and PG10) did not have a separate area for 2-5 years old children, so these playgrounds were not included in the equipment analysis. The playgrounds that are included in the equipment analysis are Hope Park Frisco Playground, Cottonwood Park Playground, Bethany Lakes Park Playground, Haggard Park Playground, Bob Woodruff Park Playground, Reverchon Park Playground, Kids Quest Mesquite and Mary Heads Parker Playground. These 8 playgrounds were located in 7 different cities in Dallas-Fort Worth Metropolitan Area which are: Frisco, Richardson, Allen, Plano, Dallas, Mesquite, and Carrollton. The only city hosting 2 playgrounds was Plano, while all the other cities host only one of the selected playgrounds.

2.1.4. Analysis of the Playgrounds

Selected playgrounds were visited in person and every piece of equipment, including components of play structures, play sets, and individual apparatuses, was recorded. All 8 of the playgrounds had a separate area for kids aged between 2 to 5. Equipment that stood outside of these areas were not included in the analysis except for the ones that were also outside of the 5-12 age area and were not specifically designated for older kids. This equipment category consists of swings, seesaws, and rotation equipment.

2.1.5. Relating the Equipment with FMS

After the analysis of the FMS and the playground equipment, all the movements and types of equipment were associated with certain body parts that are actively involved in

that motion. As the first step in this stage of the study, the equipment that is directly related to a fundamental movement was stated. Then, the section "active body parts involved" were used to correlate these pieces of equipment with the FMS they are affecting indirectly. After the completion of Table 3, correlations between existing playground equipment and FMS were stated in the results section and inferences were discussed in the conclusions section.

Table 1. Summary of FMS assessed by the 24 assessment tools

Name of the FMS	Category	Percentage of tools mentioned in	Body parts in motion
Jumping	Locomotor Movement / Non-locomotor Movement	91.7% (n=22)	Lower Body (Legs)
Hopping	Locomotor Movement	91.7% (n=22)	Lower Body (Legs)
Running	Locomotor Movement	83.3% (n=20)	Lower Body (Legs)
Skipping	Locomotor Movement	41.7% (n=10)	Lower Body (Legs)
Leaping	Locomotor Movement	37.5% (n=9)	Lower Body (Legs)
Sliding	Locomotor Movement	29.2% (n=7)	Lower Body (Legs)
Bouncing	Manipulative Movement	25% (n=6)	Upper Body (Arms)
Walking	Locomotor Movement	20.8% (n=5)	Lower Body (Legs)
Rolling	Locomotor Movement	12.5% (n=3)	Whole Body (In motion)
Crawling	Locomotor Movement	12.5% (n=3)	Whole Body (In motion)
Climbing	Locomotor Movement	4.2% (n=1)	Whole Body (In motion)
Catching	Manipulative Movement	87.5% (n=21)	Upper Body (Arms)
Throwing	Manipulative Movement	79.2% (n=19)	Upper Body (Arms)
Kicking	Manipulative Movement	62.5% (n=15)	Lower Body (Legs)
Galloping	Locomotor Movement	42% (n=10)	Lower Body (Legs)
Striking	Manipulative Movement	33% (n=8)	Upper Body (Arms)
Dribbling	Manipulative Movement	17% (n=4)	Whole Body (In motion)
Hitting	Manipulative Movement	8.3% (n=2)	Upper Body (Arms)
Dodging	Locomotor Movement	8.3% (n=2)	Lower Body (Legs)
Underarm rolling	Manipulative Movement	4.2% (n=1)	Upper Body (Arms)
Dynamic Balance	Balance	29.2% (n=7)	Whole Body (Coordination)
Static Balance	Balance	25% (n=6)	Whole Body (Coordination)
Sitting	Posture	4.2% (n=1)	N/A
Standing	Posture	4.2% (n=1)	N/A
Bending	Non-locomotor Movement	4.2% (n=1)	Whole Body (Coordination)
Stretching	Non-locomotor Movement	4.2% (n=1)	Selected Body Part
Twisting	Non-locomotor Movement	4.2% (n=1)	Selected Body Part
Turning	Non-locomotor Movement	4.2% (n=1)	Whole Body (Coordination)
Swinging	Non-locomotor Movement	4.2% (n=1)	Whole Body (Coordination)
Stopping	Posture	4.2% (n=1)	N/A
Carrying	Manipulative Movement	4.2% (n=1)	Upper Body (Arms)

Table 2: Investigated playgrounds and the types of equipment they have

Name of the Playground	Code	Location	Types of equipment
Hope Park Frisco	PG1	Frisco, TX	Hanging equipment (n=1) Tunnel (n=2) Balance equipment (n=1) Unstable or angled bridge (n=2) Horizontal slide (n=1) Steering wheel (n=6) Crawl circle (n=5) Slide (n=2)

			Stairs (n=5) Ramp/stable bridge (n=6) Swing (n=4)
Cottonwood Park	PG2	Richardson, TX	Balance equipment (n=4) Steering wheel (n=1) Slide (n=4) Stairs (n=3) Ramp/stable bridge (n=4) Swing (n=7) Seesaw (n=1) Rotation equipment (n=2) Tenpin push (n=2) Climber (n=3)
Bethany Lakes Park	PG4	Allen, TX	Tunnel (n=1) Horizontal slide (n=1) Rotation equipment (n=1) Slide (n=2) Stairs (n=2) Swing (n=5) Crawl circle (n=5) Climber (n=3)
Haggard Park	PG5	Plano, TX	Unstable or angled bridge (n=2) Steering wheel (n=2) Crawl circle (n=1) Slide (n=3) Stairs (n=3) Swing (n=4) Climber (n=3)
Bob Woodruff Park	PG6	Plano, TX	Steering wheel (n=1) Slide (n=2) Stairs (n=4) Ramp/stable bridge (n=1) Swing (n=5)
Reverchon Park	PG7	Dallas, TX	Balance equipment (n=2) Steering wheel (n=1) Tunnel (n=1) Slide (n=2) Stairs (n=1) Ramp/stable bridge (n=3) Swing (n=6) Climber (n=1)
KidsQuest - DeBusk	PG8	Mesquite, TX	Crawl circle (n=1) Slide (n=2) Stairs (n=2) Swing (n=7) Climber (n=3)
Mary Heads Carter Park	PG9	Carrollton, TX	Balance equipment (n=2) Free column (n=1) Steering wheel (n=1) Rotation equipment (n=2) Tunnel (n=1) Slide (n=2) Stairs (n=3) Swing (n=5) Climber (n=1)

Table 3: List of equipment and their relationship with FMS mentioned in Table 1.

Type of the Equipment	Used Playgrounds	Percentage of Playgrounds Used	Percentage in All Equipment in All Playgrounds	Type of Movement	FMS Affected Directly	FMS Affected Indirectly
Hanging Equipment	PG1 (n=1)	12.5% (n=1)	0.6% (n=1)	Upper Body (Arms)	N/A	Bouncing Catching Throwing Striking Underarm Rolling Hitting Carrying
Balance Equipment	PG1 (n=1) PG2 (n=4) PG7 (n=2) PG9 (n=2)	50% (n=4)	5.4% (n=9)	Whole Body (Coordination)	Dynamic Balance	Static Balance Bending Turning Swinging
Unstable or Angled Bridge	PG1 (n=2) PG5 (n=2)	25% (n=2)	2.4% (n=4)	Whole Body (Coordination)	Dynamic Balance	Static Balance Bending Turning Swinging
Horizontal Slide	PG1 (n=1) PG4 (n=1)	25% (n=2)	1.2% (n=2)	Upper Body (Arms)	N/A	Bouncing Catching Throwing Striking Hitting Carrying Underarm Rolling
Steering wheel	PG1 (n=6) PG2 (n=1) PG5 (n=2) PG6 (n=1) PG7 (n=1) PG9 (n=1)	75% (n=6)	7.2% (n=12)	Upper Body (Arms)	N/A	Bouncing Catching Throwing Striking Hitting Carrying Underarm Rolling
Crawl circle	PG1 (n=5) PG4 (n=5) PG5 (n=1) PG8 (n=1)	50% (n=4)	7.2% (n=12)	Upper Body (Arms) Lower Body (Legs)	Crawling	Rolling Climbing Dribbling
Slide	PG1 (n=2) PG2 (n=4) PG4 (n=2) PG5 (n=3) PG6 (n=2) PG7 (n=2) PG8 (n=2) PG9 (n=2)	100% (n=8)	11.4% (n=19)	Whole Body (Coordination)	N/A	Dynamic Balance Static Balance Bending Turning Swinging

Stairs	PG1 (n=5) PG2 (n=3) PG4 (n=2) PG5 (n=3) PG6 (n=4) PG7 (n=1) PG8 (n=2) PG9 (n=3)	100% (n=8)	13.8% (23)	Lower Body (Legs)	N/A	Jumping Hopping Running Skipping Leaping Sliding Walking Kicking Galloping Dodging
Swing	PG1 (n=4) PG2 (n=7) PG4 (n=5) PG5 (n=4) PG6 (n=5) PG7 (n=6) PG8 (n=7) PG9 (n=5)	100% (n=8)	25.7% (n=43)	Whole Body (Coordination)	Swinging Bending	Dynamic Balance Static Balance Turning
Ramp/Stable Bridge	PG1 (n=6) PG2 (n=4) PG6 (n=1) PG7 (n=3)	50% (n=4)	8.4% (n=14)	Lower Body (Legs)	Walking Running	Jumping Hopping Skipping Leaping Sliding Kicking Galloping Dodging
Seesaw	PG2 (n=1)	12.5% (n=1)	0.6% (n=1)	Whole Body (Coordination)	N/A	Dynamic Balance Static Balance Bending Turning Swinging
Rotation Equipment	PG2 (n=2) PG4 (n=1) PG9 (n=2)	37.5% (n=3)	3% (n=5)	Whole Body (Coordination)	N/A	Dynamic Balance Static Balance Bending Turning Swinging
Tenpin Push	PG2 (n=2)	12.5% (n=1)	1.2% (n=2)	Upper Body (Arms)	Hitting	Bouncing Catching Throwing Striking Carrying Underarm Rolling
Tunnel	PG1 (n=2) PG4 (n=1) PG7 (n=1) PG9 (n=1)	50% (n=4)	3% (n=5)	Upper Body (Arms) Lower Body (Legs)	Crawling	Rolling Climbing Dribbling
Free Column	PG9 (n=1)	12.5% (n=1)	0.6% (n=1)	Whole Body (Coordination)	Static Balance Jumping	Dynamic Balance Bending Turning Swinging
Climber	PG2 (n=3) PG4 (n=3) PG5 (n=3) PG7 (n=1) PG8 (n=3) PG9 (n=1)	75% (n=6)	8.4% (n=14)	Upper Body (Arms) Lower Body (Legs)	Climbing	Rolling Crawling Dribbling

Table 4: Body parts in motion related to FMS and playground equipment.

Body Parts in Motion	FMS	Percentage of FMS	Equipment Type	Percentage of Equipment Type
Upper Body	Bouncing Catching Throwing Striking Hitting Carrying Underarm Rolling	22.6% (n=7)	Hanging Equipment Horizontal Slide Steering wheel Tenpin Push	25% (n=4)
Lower Body	Jumping Hopping Running Skipping Leaping Sliding Walking Kicking Galloping Dodging	32.25% (n=10)	Stairs Ramp/Stable Bridge	12.5% (n=2)
Whole Body (Coordination)	Dynamic Balance Static Balance Bending Turning Swinging	16.1% (n=5)	Balance Equipment Unstable/Angled Bridge Slide Swing Seesaw Rotation Equipment Free Column	43.75% (n=7)
Whole Body (In Motion)	Rolling Crawling Climbing Dribbling	12.9% (n=4)	Climber Tunnel Crawl circle	18.75% (n=3)
Selected Body Part	Stretching Twisting	6.45% (n=2)	N/A	
None	Sitting Standing Stopping	9.7% (n=3)	N/A	

3. Results and Discussion

3.1. Results

3.1.1. The Analysis of FMS

A total number of 31 fundamental movement skills were assessed by the 24 assessment tools according to Eddy et al.'s study (2020). 29% of them (n=9) were manipulative (object control) skills, 35.5% of them (n=11) were locomotor skills, 16.1% of them (n=5) were non-locomotor skills, 3.2% of them (n=1) were locomotor or non-locomotor depending on the action type, 6.45% of the movements (n=2) were balance skills and 9.7% (n=3) were postures. The 9 manipulative movements mentioned are: bouncing, catching, throwing, kicking, striking, dribbling, hitting, underarm rolling, and carrying. The 11 locomotor skills are: hopping, running, skipping, leaping, sliding, walking, rolling, crawling, climbing, galloping, and dodging. The 5 non-locomotor skills are: bending, stretching, twisting, turning, and swinging. The only movement that can be eighter locomotor or non-locomotor is jumping since it can be jumping at a fixed point or from one point to another. The 2 balance skills are dynamic balance and static balance. Finally, the 3 skills that are categorized as posture are: sitting, standing, and stopping.

Another categorization for FMS was based on the body parts that are actively involved in the action. This section has 4 categories as follows: lower body, upper body, whole body in

motion, and whole body in coordination. “Lower body actions” are mostly associated with legs, while “upper body actions” are mostly associated with arms. “Whole body in motion” actions are the ones where both lower and upper body parts are in use. The “whole body in coordination” skills are the ones where there is no dominantly active body part and all body parts work together to keep the state of the body. The movements that were categorized as “upper body” are: bouncing, catching, throwing, striking, hitting, carrying, and underarm rolling. These skills are also all categorized as manipulative skills. The “lower body” category consists of jumping, hopping, running, skipping, leaping, sliding, walking, kicking, galloping, and dodging. Most of these skills are locomotor, one of them is manipulative, and one of them is eighter locomotor or non-locomotor. The “whole body in motion” skills are rolling, crawling, climbing, and dribbling, 3 of which are locomotor, and one is a manipulative movement. The “whole body in coordination” skills are dynamic balance, static balance, bending, turning, and swinging. The first two are balance skills and the others are non-locomotor skills. Stretching and twisting are the ones that make up the “selected body parts” category, and these movements are both non-locomotor movements. The 3 remaining movement skills are sitting, standing, and stopping for which there is no specific body part in the action. These are also the only ones that are counted as “posture skills”.

3.1.2. Analysis of the Playground Equipment

The 8 playgrounds out of 10 visited playgrounds met the criteria of having a separate play area for children aged between 2-5. All these 8 playgrounds were investigated and a total number of 167 apparatus and play structure components were identified. These apparatus/components consist of 16 types of equipment. These are slide, swing, hanging equipment, balance equipment, unstable or angled bridge, horizontal slide, steering wheel, crawl circle, ramp or stable bridge, seesaw, rotation equipment, tenpin push, tunnel, free column, and climber.

In the first playground (PG1), 11 types and 35 pieces of equipment were identified. In PG2, there were 10 types and 31 pieces of equipment. There were 8 types and 20 pieces of equipment for PG4, 7 types and 18 pieces of equipment for PG5, 5 types and 13 pieces of equipment for PG6, 8 types and 17 pieces of equipment for PG7, 5 types and 15 pieces of equipment for PG8, and 9 types and 18 pieces of equipment for PG9. Types and numbers of the equipment are shown in table 2.

As can be interpreted from table 3, swings, stairs, and slides are the 3 types of equipment that were found in all 8 playgrounds. Steering wheels and climbers were found in 75% of the playgrounds (n=6). Balance equipment, holes for crawling, ramp/stable bridge, and tunnel were found in half of the playgrounds (n=4). Rotation equipment was the only one with a rate of 37.5% (n=3). Unstable/angled brides and horizontal slides were found in 25% of the total playgrounds (n=2). Finally, hanging equipment, seesaw, tenpin push, and the free column was found in only one of the playgrounds which gives them a rate of 12.5% among all playgrounds.

Swings were the mostly encountered equipment with a rate of 25.7% among all pieces of equipment (n=43). Following that, stairs with 13.8% (n=23), slides with 11.4% (n=19), ramp/stable bridges and climbers with 8.4% (n=14), steering wheels and holes for crawling in with 7.2% (n=12), balance equipment with 5.4% (n=9), tunnels and, rotation equipment with 3% (n=5), horizontal slides and tenpin push with 1.2% (n=2), and finally hanging equipment, seesaws, and free columns dominated only 0.6% of all pieces of equipment as there were only one for each.

The “lower body” category for playground equipment consists of stairs and ramps/stable bridges which are the equipment that makes kids use their legs actively, while the “upper body” category is made of hanging equipment, horizontal slide, steering wheel, and tenpin push and these are the ones that require mostly arm movement. Balance equipment, unstable/angled bridge, slide, swing, seesaw, rotation equipment, and free column are under the “whole body coordination” category. Climber, tunnel, and crawl circle are kinds of equipment that require upper and lower body action at the same time. For this reason, they were included in the “whole body in motion” category. In contrast to FMS, there was no playground equipment under the categories of “selected body parts” and “none”. The reason for that is all the equipment required a certain movement to be played.

Most of the equipment was titled “whole body coordination” (43.75%, n=7). While 25% of them (n=4) are upper body equipment, 18.75% of them (n=3) are “whole body in motion”, and only 12.5% of them (n=2) are lower body equipment. This shows us that playground equipment is mostly focused on whole body coordination and features for improving lower body skills are lacking compared to the upper body skills and the skills that require both lower and upper body motion.

4. Conclusions and Recommendations

4.1. Conclusions

The findings show that 56.25% of the equipment types (n=9) are directly related to at least one FMS. 6 of these are related to only one FMS, which are balance equipment, unstable/angled bridge (related to dynamic balance skill), crawl circle and tunnel (related to crawling), tenpin push (related to hitting), and climber (related to climbing). 3 of the equipment types are directly related to 2 different FMS and this is the most FMS a single type of playground equipment is related to. These are swing (related to swinging and bending), ramp/stable bridge (related to walking and running), and free column (related to static balance and jumping).

The remaining 7 types of equipment (43.75% of all types) are not related directly to any FMS. These types of equipment are hanging equipment, horizontal slide, steering wheel, slide, stairs, seesaw, and rotation equipment. Even though these types of equipment are not providing the same movement as any FMS, they do help children improve some of their muscles and bones. Each type of equipment was related to some body parts that are supposed to be used when interacting with that equipment, and those parts of the body get closer to the level where the child can perform some FMS related to the same body parts. The types of equipment and their indirect relation are shown in table 3.

Only 10 of the 31 FMS are directly related to playground equipment usage. These FMS are dynamic balance, static balance, crawling, swinging, bending, walking, running, hitting, jumping, and climbing. 16 of them are related to the equipment indirectly. These are bouncing, catching, throwing, striking, underarm rolling, carrying, turning, hopping, skipping, leaping, sliding, kicking, galloping, rolling, dodging, and dribbling. Stopping, twisting, stretching, standing, and sitting are the movements that do not fall into both categories.

4.2. Limitations

This study only covers the FMS that are included in the assessment tools that are reviewed by Eddy et al. (2020) in their study. There might be more FMS, not listed in any of these tools that also need to be considered in playground settings.

The other limitation of this study is that only primary usage of the playground equipment was related to FMS. Even though these are the most popular uses of the equipment, kids always find creative ways to interact with the object. A type of equipment might be designed for sliding; however, some kids may prefer to use it as a climber and use different parts of their body. The design of the current study did not allow for the assessment of such possible uses of the playground equipment.

Another limitation is that kids tend to play with kinds of equipment that are not designed for their age. A four-year-old child might prefer to play in older kids' areas every time they go to the playground and may not interact with the equipment designed for their age. Even though this was a limitation in some way, it does not contradict the aim of the study, as this study focuses on the improvement of 2–5-year-old kids' playground area itself, and not just in comparison to 5-12 years olds'.

4.3. Implications

This study shows that there is a valid relationship between playground equipment and children's fundamental movement skills. Some of the FMS are already supported by existing equipment and the remaining FMS can be implemented in future or existing playgrounds. Further studies on the relationship between FMS and playground equipment and relevant interventions to the playgrounds may contribute to creating easy and feasible opportunities for most of the children who have access to a neighborhood playground. Findings of this study demonstrating the relationship between given playground equipment and the FMS incorporated by each may serve as a reference point for future playground designs. Moreover, results identifying the FMS that are not supported directly by any of the playground equipment offer a promising area of investigation for future playground design research.

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