

THESIS

WHAT CHILDREN DO ON THE PLAYGROUND: A RASCH ANALYSIS APPROACH TO
MEASUREMENT ON THE PLAYGROUND

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ABSTRACT

WHAT CHILDREN DO ON THE PLAYGROUND: A RASCH ANALYSIS APPROACH TO MEASUREMENT ON THE PLAYGROUND

Given the many benefits of play and children's right to play, as established by the United Nation's Convention on the Rights of the Child (1990), researchers interested in play have designed a multitude of interventions that aim to support children's engagement in this primary occupation. The school playground is a natural context for these play interventions. Because of the play deficits often associated with autism spectrum disorder (ASD) and intellectual disability (ID), many interventions target these populations. However, review of current literature suggests that researchers are limited by the lack of measurement tools to quantitatively analyze what children do together during a playground session. In this study, I present a Rasch analysis-based measure of what children do on the playground. In this measure, the playground session itself is the unit of analysis – this allows play promoters to compare playground sessions before and after an intervention, under different weather conditions, or with different groups of children. This measure was developed based on observation data collected in the context of a larger study aimed to promote playground play for children with ASD and ID. Through Rasch analysis, I demonstrate preliminary validity and reliability of data collected using this observation-based instrument. The findings of this study suggest that observation-based playground measurement tools can effectively quantify play and non-play sophistication.

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Background and Context of the Study

In Australia, as in most countries of the world, all children have the right to play. This right was established in 1990 when Australia ratified the United Nation's Convention on the Rights of the Child (UNCRC, 1990). Article 31 of these conventions establishes children's right to participate in leisure, play, and cultural activities. Article 2 of the same document establishes that these rights are guaranteed for all children, without discrimination of any kind. Lester and Russell (2010) suggested that, to uphold this commitment to children's rights, adults are responsible for providing environments that support (but do not control) children's play and for preventing environments that lead to "playlessness" (p. 42).

In this master's thesis, I intend to do my part to uphold this fundamental human right. In this chapter, I set the stage for this research study. I explore the potential for context-oriented playground-based interventions for children with autism spectrum disorder (ASD) and intellectual disability (ID). I establish the value of occupational therapy to contribute to such interventions. I provide a brief overview the Sydney Playground Project (SPP; Bundy et al., 2015), which provides both an exemplar intervention and the broader context for this study. Finally, I discuss the topic most salient to this thesis document: how we measure whether our interventions change what children do on the playground. I describe a Rasch analysis-based approach to measurement. I establish the specific aim of this study: to establish the psychometric properties of an observation-based measurement tool designed to capture what children do on the playground.

Why is Children's Play So Important?

The establishment of the right to play begs the question: why is children's play so important? Biological, developmental and evolutionary theories of play posit that it is the

mechanism through which children develop and practice motor, cognitive, and social skills that they carry into adulthood (Parham, 2008). However, current play literature suggests that children's play is not merely rehearsal for adulthood. Although children learn incidentally through play, play is valuable for its own intrinsic characteristics that benefit children's engagement in the unique experience of childhood (Lester & Russell, 2010). Through play, children express creativity, regulate their emotions, experience resilience and autonomy, and develop social and cultural connectedness (International Play Association, 2014). Perhaps most importantly, children's play brings them pleasure – as Lester and Russell (2010) stated, play is “primarily behaviour for its own sake, for the pleasure and joy of being able to do it” (p. x).

Play for Children with ASD and ID

Given the expansive benefits of play and the mandate to support children's play rights, there is a growing movement to support the play rights of children who face barriers to play (Casey, 2017). Among these children are girls, children living in poverty, children in institutions, children from minority populations, children in situations of conflict, and children with disabilities. Children with disabilities may experience both internal (e.g., limited playfulness or play skills) and external (e.g., unsupportive physical or social environments) barriers to accessing play (Hamm, 2006; Skaines, Rodger & Bundy, 2006; Woolley et al., 2006).

In this study, I focus on primary-school aged children with autism spectrum disorder (ASD) and/or intellectual disabilities (ID). Autism spectrum disorder is a neurodevelopmental disability characterized by social-interaction and communication deficits, as well as restrictive and repetitive interests and behaviors (DSM-V, 2013). A long tradition of research characterizes children with autism as poor players, particularly in the social and symbolic/imaginary domains of play (see Appendix A for a brief review of this literature). Social play deficits are generally

attributed to social and communication impairments inherent to the disorder – for example, difficulty understanding nonverbal communication, abnormal social approach or apparent disinterest in peers. Though we know less about the roots of symbolic/imaginary play differences, consistent findings suggest that children with ASD do not engage in imaginary play at the same frequency or age as their typically-developing peers (Wolfberg, 2009). When they do, their play lacks novelty and flexibility. ID is a broader disability category characterized by limitations in intellectual function and adaptive behaviors. These deficits must be present before age 18, but they can be acquired or congenital (DSM-V, 2013). Children with ID demonstrate varied patterns of play skills depending on the source and nature of their disability (Tanta & Knox, 2014). For example, they may lack the cognitive skills to initiate play. Delayed communication skills may result in more solitary play. Motor limitations may prevent them from engaging in sensorimotor play behaviors. Typically, children with lower mental age and scores for intellectual function demonstrate more significant challenges in play (Messier, Ferland & Majnemer, 2008).

Many play-based interventions for children with ASD and ID aim to remediate play deficits, often through pedagogical or behavioral methods (e.g., Martin, Drasgow & Halle, 2015; Nuzzolo-Gomez, Leonard, Ortiz, Rivera & Greer, 2002; Sigafos & Littlewood, 1999). For a number of reasons, these individual, deficit-oriented interventions could be problematic. Lockett, Bundy, and Roberts (2007) questioned whether highly-structured behavioral interventions truly lead to more intrinsically motivating, spontaneous, and voluntary play. From a pragmatic standpoint, child-centered behavioral interventions can require extensive personnel and financial resources. As a result, children with disabilities from lesser socioeconomic status may not stand to benefit from such interventions. Developmental play interventions (e.g., Weider & Greenspan,

2003; Wolfberg, 2009) may circumvent some of these problems by building upon children's existing skills and internal motivation to play through peer modeling and parental relationships. In contrast to behavioral interventions, these approaches are much more child-led. However, these interventions may still require extensive resources.

Contextual Intervention: An Alternative Approach to Promoting Play

Recent work (e.g., Broekhuizen, Sholten and de Vries, 2014; Engelen et al., 2013; Farmer et al., 2017; Hyndman, Benson & Telford, 2016) suggested that those interested in promoting children's right to play should look beyond the individual child to the contexts in which play occurs. All children's play is influenced by context; for example, during a math lesson, participating children are unlikely to engage in gross motor play. However, on the school playground, the same children may be readily running, skipping and jumping in play.

Contextual interventions present an alternative approach to play intervention for children with ASD/ID. Hamm (2006) suggested that context has an exaggerated effect on the playfulness of children with disabilities. This suggests that interventions designed to enhance the play context may be an effective and efficient way to support their intrinsic drive to play. Like developmental interventions, context-based interventions match the physical and social play environment with the needs and strengths of the children. By providing an environment that is just challenging enough, children with disabilities may naturally develop play skills. Even if their measurable play skills do not improve, children with disabilities may experience more of the intrinsic benefits of play – the sense of enjoyment and mastery of their environments.

The School Playground: A Context for Play

Given the potential for contextual interventions to support children with ASD/ID, the school playground seems like an excellent place to begin. In Australia, most schools have a

midmorning recess and a longer afternoon recess during which children typically eat lunch and then play. The unstructured, child-driven, outdoor play that takes place during recess offers children academic, social-emotional, physical and cognitive benefits (Burriss & Burriss, 2011; Holmes & Kohm, 2017). Play with natural materials (e.g., mud and sand) allows children to operationalize concepts such as mass and volume. The opportunity to be with peers affords chances to practice and learn appropriate social behaviors. However, like any play, benefits are intrinsic as well as instrumental: during recess, children have the opportunity to express themselves, enjoy themselves, and indulge in the momentary pleasure of childhood.

For children with ASD and ID, recess presents unique challenges that are frequently attributed to the children's diagnoses (e.g., a belief that inherent social-communication deficits may preclude cooperative play). While some children with ASD and ID may struggle to engage in certain types of play, perhaps more importantly, elements of the playground context may tax their play. For example, supervising adults may perceive children with disabilities as less capable and more vulnerable (Lester & Russell, 2011). As a result, they may unintentionally stifle typical playground activities characterized by challenge or perceived risk (Bundy et al., 2015; Spencer et al., 2016). Adult-directed intervention aiming to reframe their perceptions of children's capacities could prove instrumental to creating a more supportive play context. Altering the physical environment may also prove powerful. Yuill, Strieth, Roake, Aspden and Todd (2007) found that children with ASD demonstrated increased playful peer interactions on a school playground designed to facilitate physical challenge, structured movement, and imaginary play. Although this study is small ($N=3$), the findings suggest that attending to the play context may promote play.

The Role of Occupational Therapy

Occupational therapists and occupational scientists should be uniquely well-suited to contribute to playground-based interventions that address the physical and social contexts of play. First, occupational therapists enable clients through participation in meaningful and purposeful activity in their natural environments (American Occupational Therapy Association, 2014). For children, play is a primary occupation, and the school playground is a natural context. Therefore, it seems logical that occupational therapists should seek to support participation in playground play for all children. Further, occupational therapists traditionally support individuals with disabilities. We can incorporate knowledge about the disabling/enabling process to support playground play for children with disabilities such as ASD and ID. Additionally, occupational therapists may be particularly useful for designing interventions that address contexts for play. We are trained to modify environments to suit the occupational needs, strengths, and challenges of our clients. Because playground-based interventions depend on careful, thoughtful matching of the play environment with the play preference and abilities of children, skilled occupational therapists are equipped to make valuable contributions to this field.

In this study, I draw upon the concept of transactionalism as described in occupational science literature (Dickie, Cutchin & Humphry, 2006). The transactional viewpoint, borrowed from pragmatist philosopher Dewey, suggests that individuals and their contexts (e.g., physical, social, temporal, situational, etc.) are enmeshed parts of a dynamic whole. This represents a shift away from a dualistic perspective of person versus environment. Instead, the person-and-environment cannot be separated; they act upon each other. Dickie et al. (2006) described occupation as “a way to functionally coordinate the intimate person-situation relationship” (p. 90).

Considering the playground through this lens, I conceptualize the playground as a transactional unit. The items on the playground, the people on the playground and the culture of the playground represent co-defining elements of this dynamic whole. Play as an occupation emerges (or does not emerge) from the moment-by-moment transactions that occur among these and other elements. Through this viewpoint, directing intervention at the playground context seems like a natural and powerful choice.

The Sydney Playground Project: Context for This Study

The Sydney Playground Project (SPP; Bundy et al., 2015) is an excellent example of an intervention pioneered by an occupational therapist that takes a contextual approach to promoting play for children with disabilities. The measure I present in this thesis draws from data collected during the baseline phase of this intervention study. SPP is a large, multisite and multidisciplinary study that employed a novel intervention in five Australian primary school programs for children with disabilities (primarily ASD and ID). The intervention aimed to promote children's play and manageable risk-taking on the playground. The intervention included two parts – one directed toward the physical context, the other directed toward the social context. Each school participated in an initial two-term control phase to collect baseline data, followed by a two-term intervention phase. An abbreviated description of the intervention follows – full intervention details, study objectives and measurement tools are described elsewhere (Bundy et al., 2015).

Physical Context. The research team provided schools with loose, recycled materials to use on the playground environment. This intervention draws from Nicholson's (1972) Theory of Loose Parts; this theory suggests that loose, open-ended materials promote creativity, experimentation and problem-solving. Loose materials on playgrounds encourage children to

engage in more complex, active, and varied play during outdoor play (Engelen et al., 2013; Maxwell, Mitchell & Evans, 2008). This study is the first to employ this theory on the playground for children with ASD/ID. The materials supplied in this study complied with Australian standards for safety. In addition, these materials met seven criteria for selection: 1) no obvious play value; 2) encourage cooperative, active play; 3) have multiple uses; 4) can be used in challenging, creative and uncertain ways; 5) provide interesting sensory experiences (e.g., from touch or movement); 6) any hazards inherent to the materials can easily be identified and managed by a child; and 7) are, or are made from, recycled or very inexpensive materials. Materials included, for example, tires, crates, boxes and flexible pipes. Throughout the intervention period, school staff were asked not to interfere with children's play activities except if the children were at risk of harm. Researchers maintained and periodically replaced materials.

Social Context. The second arm of the intervention aimed to provide a more supportive social context for play through an adult-directed educational program. Teachers, staff and parents attended "risk-reframing" workshops. These small-group sessions, facilitated by the research team, focused on the benefits of manageable risk-taking, the consequences of limiting children's risk, and strategies for creating opportunities for manageable risk-taking. Sessions lasted approximately 1.5 hours. Each school took part in 3 risk-reframing sessions. The first session corresponded with the introduction of play materials. The second session took place approximately 3-4 weeks after the onset of the intervention. The final session corresponded with the end of the intervention phase.

Measuring What Children Do on the Playground

The challenge of employing contextual interventions lies in quantitatively measuring their effects. Consider a traditional child-oriented intervention: if we want to know how well it

facilitated play, we might measure some aspect of the target child's play before and after the intervention. For example, we might measure their skills in play or their playful disposition before and after we intervene. However, just as child-oriented interventions warrant child-oriented outcome measures, context-oriented interventions require context-oriented outcomes. Therefore, the unit of analysis must be the playground session itself. We must be able to compare one playground session to another playground session. We might be tempted to measure the play behavior of each individual child on the playground, aggregate their scores, apply our intervention, rescore every child, and compare the results. This option is problematic for several reasons. First, measuring every child on a playground is time- and resource-consuming. Second, and perhaps more importantly, this would not align with the transactional viewpoint of the playground. Measurement of individual children would not capture the rich transactions that take place among children, attending adults, and the playground itself. Up to this point, no measure captures what groups of children do on the playground.

Certainly, there are ways to measure discrete elements of what children do on the playground. To capture physical activity, for example, researchers often use accelerometers or pedometers (e.g., Ridgers, Stratton & Fairclough, 2005; Pan, 2009; Engelen et al. 2013). Systematic observation protocols such as the SOPLAY¹ (McKenzie, Marshall, Sallis & Conway, 2000) and CAST² (Zask, van Beurden, Barnett, Brooks, & Dietrich, 2001) may better capture the spontaneous, intermittent physical activity that characterizes children's play. Further measurement protocols record social behaviors on the playground – this is particularly true for interventions directed toward children with ASD (e.g., Anderson, Moore, Godfrey & Fletcher-Flinn, 2004; Kretzmann, Shih & Kasari, 2015). However, these measures generally focus on only

¹ System for Observing Play and Leisure Activity in Youth

² Children's Activity Scanning Tool

one child at a time. Although I do not diminish the importance of measuring physical activity and social behavior, these constructs alone do not tell us what the children are really doing together. Further, if we aim to promote playground play as an occupational and adaptive behavior, we cannot simply measure disparate parts of play (e.g., physical activity or social behavior). Echoing Wyver (2017), who warned against decontextualizing the cognitive benefits of outdoor play, ‘to do so would miss the point of outdoor play.’

Knowing what children are doing on the playground may prove particularly valuable for children with ASD. As discussed, difficulties in play often go hand-in-hand with ASD diagnosis. However, scholars continue to debate heartily about the source of these deficits (see Appendix A for further discussion). Much of the research cited by these scholars takes place in laboratory contexts (e.g., Charman & Baron-Cohen, 1997; Sigman & Ruskin, 1999). While valuable to understanding the nature of ASD, these studies cannot fully inform how children with ASD play in natural contexts. Studies of the school playground, on the other hand, may enrich our understanding of the mechanisms that support or inhibit play for children with ASD.

I hypothesized that what children do on the playground can be measured on an interval scale, so long as an instrument exists with items that can measure this construct. There are several criteria for such an instrument. First, the unit of analysis of the instrument must be the playground session itself in order to capture what all the children do together. Second, the instrument must be observational in nature to capture the interaction between children and the playground. Third, this instrument cannot rely exclusively on developmental trajectories for play behavior. This criterion is particularly important for two reasons. We intend to use this measure on playgrounds for children with and without disabilities. As described above, children with disabilities may not follow the same play trajectory as typically-developing children.

Additionally, developmental trajectories cannot account for all behavior on the playground – instead, qualities of the playground environment afford or diminish certain types of play. For example, swing sets and slides encourage gross motor play and provide little impetus for construction play.

Specific Aims of the Present Study

In this thesis, I propose that a Rasch model-based, observational instrument with items derived from both developmental literature and pilot observations of playgrounds may meet the criteria described above. I test this proposal through Rasch analysis of data collected using an observational iPad application designed for the SPP.

The Rasch model is a latent trait model, in which items on an instrument represent observable manifestations of some unobservable trait (often called a construct) (Bond & Fox, 2015). The Rasch model holds two core assumptions: (1) easier items are easier for all test-takers, (2) harder items are easier for test-takers with more of the latent trait than for test-takers with less of the latent trait (Bond & Fox, 2015). In this study, I use Rasch modeling to establish a construct of what children do on the playground, from least sophisticated to most sophisticated. In doing so, I test the hypothesis that what children do on the playground is a quantitative latent trait that can be measured by a set of items. The “test-takers” in this model, are the playground sessions. From this observation tool, I aimed to construct an ordered set of items that measure what children do from least sophisticated (easiest to observe at all sessions) to most sophisticated (only observed during the highest-scoring sessions).

Authoritative voices in Rasch measurement emphasize that measurement and theory in the human sciences are inextricably linked (Bond & Fox, 2015; Linacre, 2017; Wright & Stone, 1999). Therefore, the initial item set drew from both developmental play theory and pilot

observations of the playground environments (see Appendix B for initial item set). Through Rasch analysis, I refined this item set to the items that best represent, both statistically and theoretically, what children *do* on the playground. Based on the final set of items derived from this analysis, we tested the validity and reliability of data collected using this measure.

Specific research questions related to construct validity include:

- (1) Do individual items correspond with the Rasch model of the latent variable (i.e., do responses on items correlate positively with increased total measure)?
- (2) Do data from 95% of items conform to the expectations of the Rasch model, as measured by mean square fit statistics within an acceptable range?
- (3) Do rating scales within items progress logically and demonstrate sufficient spread across the range of potential scores?
- (4) Is the spread of item difficulties sufficient to capture levels of the latent variable among the sample measured?
- (5) Does the model fit theoretical expectations for playground sophistication (i.e., do relative item difficulties reflect a logical progression from simple to complex)?

Specific research questions related to reliability include:

- (6) Does the model demonstrate sufficient internal reliability, as measured by session reliability index?
- (7) Does the model demonstrate sufficient internal reliability, as measured by the number of strata associated with the observations?

In this thesis, I answer the seven research questions posed above. Having said that, my broader intention for this thesis is to advocate for children's right to play. As an emerging

occupational therapist, I cherish and champion children's right to play. I believe that a measure of what children do on the playground will allow play promoters to design, evaluate and revise their interventions to ensure that more children can exercise and enjoy their right to play.

In the second chapter, I summarize the bodies of literature that suggest the crucial nature of this study. The third chapter is formatted as a journal article, prepared for submission to the *International Journal of Play*. This chapter includes a brief introduction, methods, results, discussion, and implications. In the final chapter, I reflect on the process and outcomes of this study. I suggest critical areas for future measure development and playground research.

Literature Review

Before attempting to answer the research questions posed in the previous section, I conducted a literature review. This literature review has two purposes – (1) to establish my foundational knowledge about what children with and without ASD/ID do on the playground, and (2) to highlight gaps in current literature that my study may address. This section comprises three parts: brief review of common taxonomies used to describe play, critical review of extant tools for measuring what children do on the playground, and critical review of the body of knowledge that reflects what children do on the playground.

To collect current evidence, I searched Academic Search Premier, ERIC, MEDLINE, CINAHL, PsycInfo and PsycArticles. Search terms included “playground,” “recess,” “outcome measures,” “research method*³,” “school playground,” “play,” “social interaction,” “peer engagement,” “social engagement,” “physical activity,” “autis*,” “ASD,” “intellectual disability,” and “ID”. I reviewed abstracts for relevance to primary school playgrounds for both typically developing children and children with ASD or ID, and selected articles for full review if they contributed to the central questions posed here. I excluded articles that did not address primary school aged children (5 – 12 years old) and intervention studies that utilized only non-playground interventions (for example, social skills groups).

Taxonomies for Describing Children’s Play

Although play is notoriously difficult to define, it often takes on recognizable forms during childhood. As a result, a number of scholars have constructed taxonomies that represent common forms of play. While play is not the only thing that children do on the playground, promotion of play is central to this study. Therefore, I reviewed several common taxonomies that

³ “*” is a truncator used to search EBSCO databases. For example, searching “autis*” yields articles that contain “autism” and “autistic”

may be useful to measuring what children do on the playground. Here, I provide a brief overview of these taxonomies.

Piaget’s Stages of Play

Piaget (1962) described three stages of play that align with his theory of cognitive development: (a) practice play, (b) symbolic play, and (c) games with rules. Table 1 contains descriptions of Piaget’s play stages. Notably, Piaget’s theory does not center on play – instead, play is a medium for adults to observe cognitive development.

Table 1. *Piaget’s Stages of Play*

Stage of Play	Age	Definition
Practice Play	0-2 years old	As children learn the properties of their bodies and physical environments, they engage in sensorimotor and simple object play (e.g., banging two objects together)
Symbolic Play	2-7 years old	As language develops, children give meanings to objects and enact/manipulate these meanings through imaginary play
Games with Rules	7-11 years old	As children shift from egocentric to sociocentric and develop abstract reasoning skills, games with rules dominates their play

Piaget’s theories of play and cognition have been subjected to criticism by play theorists and psychologists. These critiques, outlined in detail by Lourenço and Machado (1996), called into question the theoretical basis of staged development as well as Piaget’s structuralist methods. Play theorist Sutton-Smith (1966), for example, criticized Piaget’s reduction of play as an unnecessary and transient side-effect of limited cognition. However, regardless of Piaget’s philosophical orientation, his play stages have been subject to adaptation and evolution to create modern taxonomies of play activities (e.g., Smilansky, 1968; Takata; 1974; Rubin, 2001; Knox, 2008; Bryze, 2008).

Smilansky's Stages of Play

Smilansky (1968) expanded on Piaget's work to generate another oft-referenced sequence of play. Smilansky's theorized that another stage of play – constructive play – emerges before symbolic play (which she terms dramatic play). During constructive play, the child manipulates materials to create an end-product. Table 2 contains Smilansky's proposed hierarchy.

Table 2. *Smilansky's Stages of Play.*

Stage of Play	Definition
Functional Play	Simple, repetitive movements; simple manipulation of objects/materials
Constructive Play	Purposeful activity where objects are combined to create something new (e.g., building sandcastle)
Dramatic Play	Child substitutes reality with imaginary situation as he or she chooses
Games with Rules	Child accepts and adjusts to pre-established rules and learns to control behavior

Scholars contest Smilansky's conceptualization of constructive play. Some scholars suggest that construction is generally product-oriented as opposed to process-oriented, and thereby may not qualify as "play" (Pellegrini & Smith, 1993). However, scholars who subscribe to a more flexible definition of play suggest that the process of construction can be sufficiently intrinsically motivating and internally controlled to be considered play. Takhvar and Smith (1990) took up the issue of construction play within the developmental hierarchy. They cited empirical evidence suggesting that constructive play does not give way to way to dramatic play; rather, construction becomes more complex and persists beyond childhood (i.e., art). Taken together, the criticisms of Smilansky's hierarchy suggest that it serves better as a classification tool (a taxonomy) than as a theoretical model for development.

Parten's Stages of Play

While Piaget and Smilansky's stages reflect the cognitive elements of play, Parten's (1932) taxonomy represents the social nature of play. Parten's taxonomy stems from her extensive observations of American, preschool-age children. Parten theorized that children advance through six stages of social play during early development. In ascending order, she described unoccupied behavior, onlooker behavior, solitary independent play, parallel activity, associative play, and cooperative play. Table 3 details these six stages, drawing from Parten's (1932) original manuscript as well as summaries from other scholars (Frost, 1992; Knox, 2008).

Table 3. *Parten's Stages of Play.*

Stage of Play	Approximate Age of Emergence^a	Definition
Unoccupied behavior	0 months	Child attends to any interesting stimuli but does not engage in play with objects. May play with his or her own body (e.g., waving arms or spinning).
Solitary play	0-6 months	Child plays with objects or toys alone with no apparent effort to engage with others.
Onlooker behavior	12-18 months	Child observes other children's play but does not enter the play. As child develops language skills, he or she may talk to the players, asking questions or giving suggestions.
Parallel play	18 months-2 years	Children play adjacent to each other, engaging with the same toys or activity but without dependent interaction
Associative play	3-4 years	Child engages in a shared activity with other children, but his or her idea dominates play and decision-making. Child may trade or share materials with others, but does not share common goal.
Cooperative play	4-5 years	Child engages in a shared activity with a common goal (e.g., a game or a project). Group members may serve different functions to achieving objective. There may be leadership and division of labor.

^aApproximate ages for typically developing children

Like Piaget's and Smilansky's, Parten's work has been subjected to criticism. When Parten (1932) conceptualized these categories of play, she described them as a developmental hierarchy, with each giving way to the next. However, when Rubin, Maioni and Hornsung (1976) examined Parten's social play in tandem with Smilansky's cognitive categories (e.g., parallel-functional play versus parallel-constructive play), they found that they do not progress linearly. Replications of this work confirmed these findings (Takhvar & Smith, 1990). Instead, children may develop social play in the order Parten described, but they retain and return to the lower categories when appropriate (Howes & Matheson, 1992; Linder, 1993). For example, a child may build a block tower with a group of children (cooperative constructive play), but he may also enjoy playing with action figures by himself (solitary dramatic play). Further, development is not the only determinant of social play behavior – environmental, cultural, social and economic factors also influence socialization in play (Xu, 2010). Despite valid criticism, Parten's categories create useful, observable categories for play scales as Rubin's (2001) Play Observation Scale and Knox's (2008) Revised Knox Preschool Play Scale.

Summary

Play taxonomies, such as Piaget's (1962), Smilansky's (1968), and Parten's (1932) provide a common language for recognizing and classifying children's play. While Piaget and Smilansky examined the cognitive elements of play, especially with objects, Parten provided a social structure. Rubin et al. (1976) presented a compelling strategy for finer categorization by creating a matrix of cognitive and social play types (e.g., constructive-parallel). However, no taxonomy fully encapsulates all activities children do in play. As Pellegrini and Smith (1993) pointed out, rough and tumble play does not fit neatly into any of these categories. Still, these taxonomies form the basis for a number of the instruments described in the next section.

Instruments

Researchers have attempted to capture what children do on the playground through a variety of approaches. Table 4 contains description of several common measurement approaches (systematic observation, behavior mapping, pedometers, accelerometers, child-specific measures, and qualitative methodologies), each with unique strengths and limitations. Table 5 contains several strategies for systematic group observation on the playground. Table 6 presents selected measures designed for the analysis of individual children. I included instruments if they were specifically playground-oriented or particularly relevant for the evaluation of playground behavior. I categorized the approaches and instruments outlined in Tables 4, 5, and 6 into four main dimensions of the playground: physical activity (PA), social behaviors (AB), play (P) and contextual factors (PC). I do not intend for this to be an exhaustive classification method; instead, this is a convenient way to observe common themes across many of the extant measures.

Table 4. *Methodologies for Playground Research*

Methodology (dimension)	Examples	Description	Strengths	Potential Limitations
Systematic Observation (PA, SB, P, PC)	See Table 2	Observers collect systematic, naturalistic data about observed behavior and context.	<ul style="list-style-type: none"> - Observers collect systematic, naturalistic data and contextual variables on playground - Momentary time sampling methods (e.g., SOPLAY) provide efficient snapshots of behavior - Continuous observation methods (e.g. CAST2) may provide more detailed observation of behavior over time - Flexible approach, researchers may implement coding schemas to fit desired variables - Generally inexpensive, no equipment - May be streamlined by use of handheld digital devices for data collection (McKenzie, 2016) 	<ul style="list-style-type: none"> - Interrater reliability must be systematically established, may require intensive training to achieve acceptable agreement - Depending on method, may be time consuming

^aDimensions: PA: physical activity; SB: social behavior, P: play, PC: playground context

Methodology (dimension)	Examples	Description	Strengths	Potential Limitations
Behavior Mapping (PA, SB, P, PC)	Tranter & Malone (2004); Cosco, Moore & Islam (2010); Azlina & Zulkiflee (2012)	Based on the concepts of affordances and behavior settings, this strategy employs an ecological approach to direct observation (Cosco, Moore and Islam, 2010). Behaviors are recorded in tandem with physical location on an agreed-upon map of target area.	<ul style="list-style-type: none"> - Provide rich, contextual detail which can inform environmental interventions and design - Flexible approach, researchers may implement coding schemas to fit desired variables 	<ul style="list-style-type: none"> - Interrater reliability must be systematically established, may require intensive training to achieve acceptable agreement - May be time consuming
Pedometers and Accelerometers (PA)	Hyndman, Benson, Ullah & Telford (2014); Bundy et al. (2011); Ridgers et al. (2005)	These measures use children's steps (pedometers) or movement in space (accelerometers) through wearable devices to examine physical activity (PA).	<ul style="list-style-type: none"> - May offer high precision and accuracy, depending on monitors used - Provide objective data - Minimal training required 	<ul style="list-style-type: none"> - May be costly or unfeasible for large groups - Participant burden: must be worn during observation periods - Capture only one dimension of playground activity (PA) - Accelerometry uses time-sampling – tool must be able to capture small enough time periods (epochs) to reflect children's spontaneous movement patterns (Ridgers et al., 2005)
Child-Specific Measures (SB, P, PC)	See Table 3	Surveys, checklists, observation protocols generate information	<ul style="list-style-type: none"> - Often more useful for specific diagnostic criteria (e.g., POPE; POC) 	<ul style="list-style-type: none"> - Due to focus on single children, these measures are not likely to capture the complex,

^aDimensions: PA: physical activity; SB: social behavior, P: play, PC: playground context

Methodology (dimension)	Examples	Description	Strengths	Potential Limitations
		about individual children on the playground. Some methods are analyzed based on single child's results, while others are generally interpreted for the group.		<p>environment- and social-driven transactions that occur on the playground</p> <ul style="list-style-type: none"> - Relatively few tools relevant for playground environment - Varied psychometric properties
Qualitative Methodologies (PA, SB, P, PC)	Izumi-Taylor, Samuelsson & Rogers (2010); Pawlowski, Andersen, Troelsen & Schipperijn (2016); Powell, Woodfield & Nevill (2016); Izumi-Taylor & Ro (2017)	Researchers may conduct focus groups, surveys, unstructured observations & interviews to collect childrens' and adults' perspectives of playground. Various methods include narrative approaches, ethnographic approaches and case studies.	<ul style="list-style-type: none"> - Incorporate participants' perspectives - May provide rich contextual perspectives 	<ul style="list-style-type: none"> - Participant burden - Time consuming - May be difficult to transfer to practical applications

^aDimensions: PA: physical activity; SB: social behavior, P: play, PC: playground context

Table 5. *Direct Observation Tools.*

Instrument (Dimension)	Author (Discipline)	Age	Description	Psychometrics^b	Notes
System for Observing Play and Leisure Activity in Youth (SOPLAY) (PA, PC)	McKenzie, Marshall, Sallis & Conway, 2000 (Exercise and nutritional science)	School-aged (K-12)	Systematic observation protocol designed to measure children's physical activity levels within the playground context	Interrater reliability: contextual variables (N = 24 schools): 88-97% (<i>substantial agreement</i>); Activity counts (N = 24 schools): intraclass correlations .76 - .98 PA codes validated with heart rate monitoring	- Observers scan all children (alternating female and male) within targeted areas, counting frequency of sedentary behaviors, walking, and vigorous PA - Authors recommend at least 2 observations of each target area per observation period, and at least 3 days of observations for reliability - Saint-Maurice, Welk, Ihmels & Krapfl (2011) measured PA codes against accelerometry and found evidence that these codes may exaggerate time spent in moderate-to-vigorous PA
System for Observing Children's Activities and Relationships during Play (SOCARP) (PA, SB, PC)	Ridgers, Stratton, & McKenzie 2010 (Sport and exercise sciences)	School-aged (K-12)	Systematic observation protocol designed to measure children's PA, social behavior and activity types	Interrater reliability (n=114 children) 88-90% (<i>substantial agreement</i>) Concurrent validity with accelerometry (n=144): r=.67, p <.01	- 10 second observing interval followed by 10 second recording interval for each child targeted for observation - Captures multiple dimensions of playground activity - Social behaviors are limited to prosocial and antisocial behaviors,

^aDimensions: PA: physical activity; SB: social behavior, P: play, PC: playground context

^bUnless otherwise noted, all psychometric properties were established by the author

System for Observing Play and Recreation in Communities (SOPARC) (PA, PC)	McKenzie & Cohen, 2006 (Exercise and nutritional science)	Any age	Systematic observation protocol designed to measure contextual factors and children and adults' demographics and PA in parks and recreational spaces	Interrater reliability not reported by authors, but Evenson et al. report >80% reliability (<i>substantial agreement</i>) in systematic review of studies using SOPARC	<ul style="list-style-type: none"> - Similar protocol to SOPLAY - Contains methods for scanning jogging tracks - Not traditionally used for schools, but may be useful when school grounds contains a track (e.g., Cotton, Dudley, Jackson, Winslade & Atkin (2017); Black, Menzel & Bungum (2014))
System for Observing Outdoor Play (SOOP) (P, SB, PC)	Engelen et al., 2017 (Public health)	Primary school-aged	Systematic observation protocol for recording play and non-play activities, groups and their sizes, and presence of teachers	Interrater reliability (n= unreported), 95% (<i>substantial agreement</i>)	<ul style="list-style-type: none"> - One observation per minute, scanning anti-clockwise - Includes play type categories instead of specific play activities - Recommend further psychometric testing and research
Children's Activity Scanning Tool 2 (CAST2) (PA, PC)	Zask et al., 2001 (Public health)	5 – 12 years old	Systematic observation protocol designed to measure children's PA in the playground context; contextual variables include equipment availability and adult behavior	Interrater reliability: $\kappa = .72 - 1$; Chronbach's $\alpha = .93 - .99$ Criterion validity: number of children as counted by independent observer vs. measure of children observed by raters; Pearson's coefficient = $.81 - .97$	<ul style="list-style-type: none"> - Continuous 75 second scans, alternating between PA scans and contextual variables; authors recommend three days of scanning for reliability

^aDimensions: PA: physical activity; SB: social behavior, P: play, PC: playground context

^bUnless otherwise noted, all psychometric properties were established by the author

Table 6. *Individual Child Measures.*

Instrument (Dimension)	Author (Discipline)	Age	Description	Psychometrics^b	Notes
Manchester Inventory for Playground Observation (MIPO) (SB)	Gibson, Hussain, Holsgrove, Adams & Green (2011) (Developmental Psychology)	5 – 11 years old	28-item observational assessment which measures 4 domains of social functioning during naturalistic playground observation	<p>Internal consistency: $\alpha = .92$, $n = 144$</p> <p>Interrater reliability: $\kappa_w = .77$, $n = 39$</p> <p>Test-retest reliability after 7 – 14 days: $\kappa_w = .577$, $n = 39$</p> <p>Convergent validity: significant correlation ($r = .782$, $p < .001$, $n = 68$) with teacher-reported Social Skills Rating System (SSRS)</p> <p>Cutpoint established at 13 for discriminating between children with and without ASD established at 13/28 or below, sensitivity = 65.3%</p>	- Recommend further psychometric research to establish utility of this tool
Playground Observation of Peer Engagement (POPE) (SB, PC)	Kasari, Rotheram-Fuller & Locke (2005) (Psychology)	5 – 12 years old	Single-child time interval behavioral coding system used to collect naturalistic data about children's social functioning in playground environment	<p>Interrater reliability reported by Kretzmann, et al., 2015: $\kappa = .92$</p> <p>Cutpoint for discriminating between ASD and non-ASD recommended by Locke, Shih, Kretzmann, Kasari (2016): 53% or less of recess</p>	- 40 seconds of observation followed by 20 seconds of recording; authors recommend minimum of 10 minutes per recess session

^aDimensions: PA: physical activity; SB: social behavior, P: play, PC: playground context

^bUnless otherwise noted, all psychometric properties were established by the author

				time spent unengaged (sensitivity, .73; specificity, .79, n = 51)	
Play Observation Scale (POS) (P)	Rubin (2001) (Developmental psychology)	Unspecified; relevant for school-aged play	Play taxonomy and observational system	Interrater reliability established by Rubin, Cheah & Fox (2001): $\kappa = .92$	- Rubin (2001) reports that other studies have reported “uniformly high” kappa for interrater reliability using this coding schema
Playground Observation Checklist (POC) (SB, P)	Ingram, Mayes, Troxell & Calhoun (2007) (Psychology and education)	5 – 11 years old	10-item checklist designed to assess playground environments, including social behavior and play skills.	Interrater reliability (n = 15): 100% (<i>excellent agreement</i>) Cutpoint for discriminating between ASD and non-ASD recommended by Ingram et al. (2007): 3/4 or below on 4 social items (sensitivity; 1.0; specificity, .92, n = 81)	- Not frequently used - Recommend further psychometric research to establish utility of this tool
Test of Playfulness & Test of Environmental Supportiveness (ToP and TOES) (P, PC)	Skard & Bundy, 2008 (Occupational therapy)	6 months – 18 years	ToP: 30-item assessment of children’s approach to play; items are evaluated based on extent, intensity and/or skill (as applicable) on a 4-point scale ToES: 11-item environmental	Construct validity of ToP: established by Rasch analysis, 96% of test items, 93% of participants and 95% of raters fit the model Construct validity of ToES: established by Rasch analysis, 94% of items, 95% of environments, and 96% of overall scores fit the model	- Studies suggest that test-retest reliability is only moderate; author suggested that this may be the result of environmental influence on the operationalization of playfulness trait (Bundy, 2008) - Not specifically designed for playground environment, but appropriate for use on playground

^aDimensions: PA: physical activity; SB: social behavior, P: play, PC: playground context

^bUnless otherwise noted, all psychometric properties were established by the author

			observation of play area's supportiveness of playfulness, meant to be administered in conjunction with ToP		
Lunchtime Enjoyment of Activity and Play Questionnaire (LEAP) (P)	Hyndman, Telford, Finch, Ullah & Benson (2013) (Health and physical education)	8 – 12 years old	39-item questionnaire based on 5-point pictorial Likert scale designed to collect children's perceptions about play and physical activity during lunch and recess times in schools	Test-retest reliability (35/39 items): $\kappa_w = .44-.78$ (<i>moderate reliability</i>); test-retest reliability lower for female participants Internal reliability: Chronbach's $\alpha = .74-.88$ (<i>moderate reliability</i>) for intrapersonal and physical environment/policy questions (37/39 items); interpersonal items (2/39) failed to reach moderate reliability	- Recommend further psychometric research to establish utility of this tool

^aDimensions: PA: physical activity; SB: social behavior, P: play, PC: playground context

^bUnless otherwise noted, all psychometric properties were established by the author

Instruments to Assess Physical Activity

Many of these assessment approaches enable observation of physical activity on the playground (see SOPLAY, SOPARC, SOCARP, CAST2, accelerometers, pedometers). The proliferation of tools to assess physical activity is likely related to the reported rise in childhood obesity. Indeed, the World Health Organization (WHO) (2016) reported that nearly 1 in 5 children worldwide is overweight or obese, a figure that has tripled in the last four decades. This compelling problem likely led to funding opportunities for methodologies that capture increased physical activity, a factor that may mitigate obesity (Ginsburg, 2007). The authors of both SOPLAY and CAST2 cited childhood obesity as an impetus for developing tools to measure physical activity (McKenzie et al., 2010; Zask et al., 2001).

Physical activity measures present a range of strengths and limitations. Objective measures such as accelerometry and pedometry characterize movement on the playground through direct measurement (see, for example, Ridgers et al., 2005; Pan, 2008; Engelen et al., 2013). Measures of individual children can be combined to study movement patterns across groups of children. However, these tools best capture ongoing physical activity, such as jogging or walking, and may not fully capture the spontaneous physical activity of children in play (Ridgers et al., 2005). Time sampling methods, such as SOPLAY, capture physical activity in momentary snapshots. The human observer may determine physical activity more accurately, but these methods are limited to momentary snapshots and place burden on researchers to rigorously train observers. A notable strength among these measures is flexibility – the author of SOPLAY encourages researchers to employ other coding schema to observe behaviors beyond physical activity (McKenzie, 2016). SOCARP, SOPARC and SOOP developed from variations of the SOPLAY protocol (McKenzie & Cohen, 2006; Ridgers et al., 2010; Engelen et al., 2017).

Instruments to Assess Social Behavior

One included instrument assesses social dynamics of the playground environment, while three instruments measure social behaviors and skills of individual children. The System for Observing Children's Activities and Relationships during Play (SOCARP) demonstrates strong interrater reliability, but limited resolution – behaviors are categorized as either prosocial physical, antisocial physical, prosocial nonphysical and antisocial nonphysical (Ridgers, et al., 2010). This may not capture the complexities of school playground social behaviors. The child-specific instruments capture more detailed social behaviors, but measuring all children is often unrealistic. Even if all children were measured, the results would not capture the nuanced interactions among children.

Of note, most of the individual child measures are designed for specific diagnostic populations, including ASD and ID (e.g., Ingram et al., 2007; Gibson et al., 2011; Kasari et al., 2005). In addition, Bauminger (2002) created a coding scale of observable social-communication behaviors for children with high-functioning autism within their school environments. Other researchers adopted this scale to systematically categorize playground interactions (e.g., Wood, Fujii, Renno & Van Dyke, 2014). Adoption of such taxonomies in combination with direct observation protocols may present a promising way to capture more detailed information about social interactions and behaviors on the playground, particularly among children with ASD and ID.

Instruments to Assess Playground Play

In addition to physical activity and social behaviors, researchers have attempted to measure play activities. Many researchers (e.g., Holmes, 2012) have described specific play and sport activities. Although useful, this information will likely never be comprehensive – given the

nature of play, children's playground activities could create an infinitely long list. Other researchers have circumvented this problem by addressing types of play. Tranter and Malone (2001), for example, used a taxonomy of play types in conjunction with behavior mapping to analyze the potential for nature-based playgrounds to support environmental learning. More recently, Engelen et al. (2017) created the System for Observing Outdoor Play (SOOP), using play categories based on pilot observations. In addition to these objective measures, researchers have used qualitative methodologies to collect children's and teacher's perspectives of play on the playground (e.g., Izumi-Taylor et al., 2017; Parrish, Yeatman, Iverson & Russell, 2012).

As in social behavior, researchers use individual assessments to evaluate the play of individual children within the primary school recess environment. Many of these instruments rely on Parten's (1932) and Piaget's (1962) play categories to assess play of individual children within the primary school recess environment (e.g., POS). These instruments address a variety of dimensions of play, including skills, approach, participation and enjoyment. In this review, I have excluded laboratory-based play assessments, as they do not directly inform our understanding of playground play. Apart from the ToP/TOES (Skard & Bundy, 2008) and the POS (Rubin, 2001), these tools are not widely used and have tenuous psychometric properties.

Instruments to Assess Playground Context

Although the playground environment is not the main dimension studied in any of the tools described in Tables 4 to 6, elements of the environment are woven throughout several. In behavior mapping, physical context is foregrounded – for example, Azlina and Zukiflee (2010) created a detailed map of a Malaysian playground, including surfaces, attached objects and loose objects. Researchers used systematic observation to collect a variety of contextual variables, including the presence and behavior of teachers or other adults, availability of equipment, and

park usability. Researchers have used qualitative methods to characterize children's perspectives of the playground context with other dimensions of the recess environment such as play activities, social behaviors and physical activity (e.g., Parrish et al., 2011; Powell et al., 2016; Pawlowski et al., 2016). Researchers using GPS technology may supplement these approaches to provide further detail about the spaces where children play (Pawlowski et al., 2016).

Generally, the individual measures here do not account for contextual data (with the exception of the ToP/TOES [Skard & Bundy, 2008]). However, if these tools are combined with environmental interventions, they could contribute valuable knowledge about the role of the context in supporting or inhibiting play, social behavior and physical activity.

In addition to the tools presented here, researchers employ measures to assess the quality, accessibility and safety of playground equipment (e.g., State of Victoria [Department of Education and Early Childhood Development], 2012). Although informative, these (often proprietary) tools are limited in scope and do not include interactions between children, adults and the playground environment.

Limitations in the Current Literature

The tools presented in this literature review measure elements of what children do on the playground, though each has limitations. Physical activity measures are widely used – however, they are subject to high variation (Saint-Maurice et al., 2011). This limits the generalizability of findings using these methods. Meanwhile, measurements of social behaviors are less common, and the single group-based measure provides only shallow categorical data. While researchers may use individual measures to reflect richer data about social interaction within individual children, they cannot fully characterize the playground as a whole. Instruments to assess play are limited by the complexity of the construct they measure – interpretations of play vary across the

measures represented here. In addition, these largely do not address the role of the environment. Beyond the tools presented here, additional studies employ study-specific observation systems and taxonomies to observe additional outcomes and dimensions of the playground (e.g., Boulton, 2005; Wood, Fujii, Renno & van Dyke, 2014). Although these strategies enrich our knowledge of the school playground, the heterogeneity in results presents a challenge when synthesizing conclusions about the factors that affect the playground.

Certainly, other dimensions beyond physical activity, social behavior and individual play contribute to the playground environment – for example, adult and non-play behaviors. Currently, researchers have no widely-accepted methodologies to collect these other dimensions. However, without consideration of these aspects, our conceptualization of the school playground is incomplete. Recent work suggests innovative ways to capture these other dimensions. For example, Massey et al. (2017) modified the Coaching Behavior Assessment System (CBAS; Smith, Smoll & Hunt, 1977 as cited in Massey et al., 2017) to the school playground environment to measure the frequency and quality of interactions between adults and children. Additionally, Engelen et al. (2017) developed codes for SOOP based on behavior observed during pilot studies in the subject school; as a result, they included contextually-relevant behaviors. For example, because Australian children eat lunch on the school playground, the authors included eating as a non-play behavior. Flexible protocols such as this can introduce further dimensions for future study and allow researchers to describe the behaviors most relevant to their study and unique playground environments.

Despite the promise of these innovative methodologies, adding dimensions will not completely fill the gaps in our understandings. The playground is rich with transactions among children, adults, and elements of the playground context; thorough measurement of the

playground must represent this nature. Several methodologies presented here do reflect this multidimensionality through simultaneous contextual data. However, only two methods integrate more than two dimensions – SOCARP (Ridgers et al., 2010) and SOOP (Engelen et al., 2017). These instruments may contribute to a more nuanced understanding of the playground.

In summary, current instruments reflect only a few of the many dimensions of the playground environment. Although there are tools to measure play, physical activity and social behavior in the playground context, few instruments reflect the complex, multidimensional nature of the playground. No current instruments allow researchers to answer the central question posed in this study: *what do children do on the playground?*

What do children do on the playground?

Armed with the tools described above, researchers from many disciplines have entered the world of children on the playground, viewing these unique spaces through a variety of lenses. Researchers from exercise and sport science and public health frequently focus on physical activity (e.g., Ridgers, Salmon, Parrish, Stanley, & Okely, 2012; Willenberg et al., 2010; Zask et al., 2001), while psychologists largely dominate conversations about play and social behavior (e.g., Rubin, 2001; Kasari et al., 2005). In this section, I synthesized and critiqued current literature surrounding what children do on the playground. For simplicity, I organized this literature into the same dimensions described above: physical activity, social behavior, and play. Most of literature in the playground arena surrounds typically-developing children. However, some articles characterize the play of children with disabilities. In the final section of this review, I synthesized current evidence specific to these populations. I highlighted the need for further research about what children do on the playground.

Physical Activity

As reflected by the quantity of physical activity measures, an extensive body of literature quantifies physical activity on the school playground. The World Health Organization (WHO) recommended that children ages 5-17 engage in moderate to vigorous physical activity (MVPA) for at least 60 minutes each day (WHO, 2011). Recess should provide an opportunity for children to be active (Hyndman et al., 2016). However, as many as 40% of Australian children, who tend to have more time for recess than children in other countries, do not meet these objectives (Australian Health Survey, 2011-12).

Individual variables. Researchers have explored individual factors that may explain variations in playground physical activity. Ridgers et al. (2012) extracted data from 53 peer-reviewed studies that measured associations between physical activity and other variables. The authors found strong evidence from 38 studies that suggested boys are consistently more active than girls during recess. Although variations attributable to gender are well established, other individual factors are not so clear. For example, three articles suggested that children with special education needs are less active in recess periods (Foley, Bryan, McCubbin, 2008; Pan, 2008a; Pan, 2008b), while an additional three studies revealed no relationship between these two variables (Faison-Hodge & Poretta, 2004; Rosser Sandt & Frey, 2005; Tsuji et al, 2007). One study (Tsuji, Okado, Kaku, Hanada & Shirakawa, 2009) reported mixed results across disability types. It is interesting to note that three of four studies that specifically reported on children with autism spectrum disorders found that these children demonstrated decreased physical activity compared to typically-developing peers. This suggested that individual disability factors may correlate with amount of physical activity.

Ridgers et al. (2012) found no relationship between physical activity and BMI, although this is inconsistent across the literature (see Hyndman et al., 2016). Additionally, the relationship between age and physical activity is not well-established. Although most studies included in recent reviews suggest that younger children are more active than older children, other studies suggest that the opposite is true. According to Hyndman et al. (2012), accelerometers and pedometers may fail to capture characteristic movement differences between these two age groups – for instance, older children take larger and less frequent steps than younger children. This suggests that direct observation methodologies may be more helpful to compare these groups. Other individual characteristics, such as fundamental motor skills, self-efficacy, play preferences, religion and ethnicity remain relatively unexplored and warrant further research (Hyndman et al., 2016; Ridgers et al., 2012).

Environmental variables. Characteristics of the playground environment impact children's physical activity levels. Researchers in the field of psychology referred to this as *affordance* (Gibson, 1969, as cited in Waters, 2017); stated simply, qualities of objects or environments invite – or afford – different kinds of behavior. Across the literature, the provision of loose play equipment is positively correlated with increases in active play (Broekhuizen et al., 2014; Engelen et al., 2013; Hyndman et al., 2016; Ridgers et al., 2012; Roberts, Fairlcough, Ridgers, & Porteous, 2012; Willenberg et al., 2010). Fixed equipment, such as jungle-gyms and slides, have an inconclusive effect on physical activity (Ridgers et al., 2012). The role of the environment likely interacts with other factors. For example, Dymont, Bell and Lucas (2009) suggested that girls engaged in more physical activity on manufactured equipment as opposed to grassy fields or asphalt areas, as the manufactured equipment provides more opportunities for non-competitive, non-sport play. Further, Roberts et al., (2012) found that boys' physical activity

increased as the size of their play group increased, while girls' active play did not correlate with group size.

An emerging body of literature suggested that environments supporting challenging, open-ended play may increase children's physical activity. For example, Engelen et al. (2013), in a cluster randomized controlled trial, introduced large, loose materials to six primary school playgrounds. These items, including milk crates, tires and swaths of fabric, were chosen based on characteristics that encouraged cooperation and creativity. This playground-based intervention was supplemented by an adult-directed intervention aimed at increasing parents' and playground supervisors' knowledge about the benefits of healthful risk-taking for children. Engelen et al. (2013) found small but statistically significant increases to physical activity on intervention playgrounds. Farmer et al. (2017) worked with seven schools to modify the playground environment to encourage risk and challenge in play. Methods were school-specific and included policy changes, such as changes to school rules to allow tree-climbing. Both studies used accelerometry to measure children's physical activity. Farmer et al. (2017) found no significant differences, but teachers reported that children engaged in more physical activity.

These two studies may be limited by the sole use of accelerometry, which may not fully capture the spontaneous and multi-directional motions that characterize children's physical activity during play—especially when using loose parts. Hyndman et al. (2014) evaluated an intervention using recycled materials using SOPLAY and pedometry – they found that, while pedometer-based measures of PA increased only slightly, SOPLAY data revealed significantly higher-intensity PA after the intervention. He suggested that children may not have accumulated as many steps because they were playing with purpose around spaces they constructed using

loose materials. Accelerometry, while more sensitive than pedometry, may also cause researchers to miss more significant gains in physical activity.

Social Behaviors

Recess time can be crucial to children's social development as it provides an opportunity to develop negotiation, sharing and cooperation with peers (Holmes & Kohm, 2017).

Unstructured, child-driven recess play promotes rehearsal of social skills and provides a context for children to develop resilience and confidence (Burriss & Burriss, 2011; Ginsburg, 2007).

Studies suggested that typically developing children engage in frequent prosocial behaviors on the playground – for example, assisting each other and cooperating (Ridgers et al., 2010; Roberts et al., 2012; Powell et al., 2016). Girls and boys exhibited different patterns of social behavior, with girls tending to congregate in small groups while boys formed larger groups, often to play organized sports (Ridgers et al., 2010; Roberts et al., 2012). Motor ability may also play a role in social behavior. In one study, kindergarteners with lower motor skills demonstrated more social reticence and spent less time engaged with other children during free-play than their peers with more motor ability (Bar-Haim & Bart, 2006).

Despite these observations, a large body of research has explored antisocial behaviors on the playground such as bullying and exclusion (Craig et al., 200). Vaillancourt et al. (2010) described the playground as a “place to avoid” based on a study of more than 10,000 Canadian school children's perceptions of high-risk bullying areas. Farmer et al. (2017) explored the impact of the risk-enhancing environmental intervention described previously on bullying from children's, teachers' and parents' perspectives. They found small significant differences in the reported happiness of children in the intervention schools 1 and 2 years after the intervention began, though no significant change in the incidence of bullying as reported by teachers and

parents. Interestingly, they found small but significant increases in pushing and showing in intervention schools as reported by children. However, this did not correlate with an increase in reports of bullying to teachers. The authors posited that this discrepancy suggested that the riskier and more challenging playground environment promoted children's independent resilience and problem-solving skills.

Play

Most of the physical and social behaviors described above occurred in the context of play. Children engaged in an ever-expanding variety of play activities on the playground (Holmes & Kohm, 2017). These play activities included (but were certainly not limited to) chasing, rough-and-tumble play, play on equipment, talking in groups, organized games, and jump-roping. The list of possible play activities likely stretches beyond the imagination of the adults who attempted to collect it. Luckily, children have contributed to the conversation as well. Armitage (2010), in the context of a larger study, surveyed 48 children about their favorite and least favorite things to do on the playground. The children indicated that they enjoyed playing and socializing on the grassy field, while playing on play structures was least desirable. Notably, however, children who had only occasional access to fixed equipment due to policy or availability indicated that they enjoyed playground equipment more than children who had regular access. Additionally, Parrish and colleagues (2012) surveyed 20 primary school children about the influence of the playground environment on their play activities. They found a pervasive belief that loose sport equipment, such as bats and balls, encouraged play and made the children more active.

Individual Factors. Evidence suggested that characteristics of the player influence the nature of chosen play activities. Given the intersections between physical activity, social

behavior and play on the playground, conclusions from literature in these areas may reflect differences in play choices. As described above, gender influences social behavior and physical activity on the playground – this leads to qualitative differences in play. Literature suggested that girls engage more frequently in non-play activities such as talking, while boys often gravitate toward sports and organized games (Dyment et al., 2009; Holmes, 2012; Pellegrini, Kato, Blatchford & Baines, 2003; Ridgers et al., 2010; Roberts et al., 2012). Additionally, Bar-Haim and Bart's (2006) findings reflect fundamental differences in play activity choices across children with variations in motor skills; the authors posited that children with low motor skills likely had more difficulty entering social play situations that demanded motor skill, such as playing on fixed equipment or engaging in sports.

The role of age is clear in play literature. Developmental theories of play suggest that as children get older, their play becomes more sophisticated and complex, and requires more peer-to-peer interaction (Parten, 1932; Parham, 2008; Piaget, 1962). Observational studies of children on the playground supported this theory – as children age, they abandon simple games such as chasing for more complex sports and games with rules (Holmes, 2012; Pellegrini et al., 2003).

Environmental factors. Like physical activity, play activities are certainly influenced by the affordances of the play environment. Literature suggested that green spaces in outdoor playgrounds provide diverse affordance to playing children, including space for organized games, socialization and quiet, gentle games (Azlina & Zukiflee, 2012; Dyment et al., 2009; Tranter & Malone, 2004). Beyond the spatial qualities, interviews with children suggested that the objects present on the playground impact their play choices (Armitage, 2010; Willenberg et al., 2010; Parrish et al., 2011). Recent experimental studies suggested that loose materials with no obvious play value influence play by drawing on children's intrinsic motivation to engage in

challenging, open-ended play (Bundy et al., 2011; Hyndman et al., 2014). Pawlowski and colleagues' (2016) findings supported the notion that the play environment impacts activity choices. In this mixed-methods study, they connected physical activity with play choices and playground context. Children who played soccer dominated the large, grassy fields of this Danish elementary school, while children who preferred to socialize during recess stayed indoors.

Adults' Roles on the Playground

Adults may serve a variety of roles on the playground. While two studies suggested that increased supervision corresponded with decreases in children's physical activity (Ridgers, Stratton & McKenzie, 2010; Zask et al., 2001), two other studies found the opposite pattern (Sallis et al., 2001; Willenberg et al., 2010). Pawlowski et al. (2016) suggested that increased adult supervision could lead to conflict resolution that would otherwise present a barrier to physical activity. Holmes (2012) found that girls interacted more with adults than boys; however, this was the only study that suggested a relationship between gender and adult involvement. Hyndman et al. (2016) posited that the variation in the role of adults may be related to cultural factors and differences among the actions and attitudes of the adults supervising recess. This is congruent with Reed, Dunbar and Bundy's (2010) finding that a playful adult facilitator can increase children's playfulness, while a less playful adult may stifle play instead.

Experimental studies reflected the unsettled role of adults on the playground. Massey et al. (2017) advocated for adults to take a more active role in structuring recess playtime, describing unstructured recess times as "low-functioning". In this large, experimental study, they trialed Playworks, a "semi-structured" approach in which non-teacher adult "coaches" joined the playground environment and facilitated organized games. They found that students engaged in 38% more prosocial interactions with adults when this program was implemented. While

teachers reported a decrease in student bullying in intervention schools, the children disagreed, reporting no difference in relationships with other students. Massey and colleagues' results are indicative of disconnect between children's and adults' perceptions of the value of engaged adults on the playground. Armitage (2010) observed this disconnect through student interviews following a "play pod" intervention in which children were given access to loose materials for play. Children suggested that increased adult presence would interfere with playing. Armitage also noted that, while adult playground observers felt that children's recess-time play lacked imagination and creativity, children expressed playing highly imaginative games outside of the eye-sight of adults. Armitage concluded that the concern and responsibility that adults feel for facilitating play may be unnecessary within populations of typically developing children.

The Playground for Children with ASD and ID

While there is a growing body of evidence about recess and the playground, relatively little quantitative research characterized playground play for primary school children with ASD and ID. However, participatory research suggested that, for children with disabilities (like those without), the playground is a place where they can express agency, develop resilience and experience joy (Burke, 2012). In this section, I synthesized and critiqued the extant body of literature related to this population, including observational studies and intervention studies.

Physical Activity. At this point, patterns of playground physical activity for children with ASD and ID are unclear. Some studies suggested that children with ASD engaged in less recess physical activity than typically-developing peers (Pan et al., 2008; Tsujii et al., 2009). Others implied that there is no relationship (Rosser-Sandt & Frey, 2005). Results were equally mixed for children with ID. Heart-rate and accelerometry data from one study suggested that males with ID were more physically active during recess than those without (Lorenzi, Horvat & Pellegrini,

2000), while another suggested a negative correlation (Foley, Bryan & McCubbin, 2008). Systematic observation of children with ID suggested no association with physical activity (Faison-Hodge & Poretta, 2004; Lorenzi, Horvat & Pellegrini, 2000). This supported Pitetti, Beets and Combs' (2009) finding that, between recess and physical education, elementary school children with ID meet the American standards for PA (at least 60 minutes of moderate-to-vigorous PA). However, the authors acknowledged that this study concerned only one school. Notably, this school greatly exceeded national requirements, offering two 25-minute recess periods. They also had a nationally-recognized physical education teacher. Therefore, they suggested, further research should examine whether children with ID at other schools are afforded such opportunity.

Few studies compared disability types. Sit, McManus, McKenzie and Lian (2007) found that children with ID in specialized school settings engaged in less physical activity than children with hearing impairments and visual impairments, though more than children with physical impairments. However, they assessed each group of children at different schools; therefore, these results do not account for variation among the playground environments. Boddy, Downs, Knowles and Fairclough (2015) observed children with ASD and non-ASD ID in specialty school settings using SOCARP and accelerometry— they found that children with ASD engaged in significantly more vigorous physical activity than children with other disabilities. On the other hand, Bingham, Boddy, Ridgers and Stratton (2015) found, using a similar methodology, that children with ASD demonstrated less physical activity than peers with behavioral and emotional needs and “other” disabilities (not described). However, much like the Sit et al. (2012) study, these studies did not account for different school policies and school environments.

Physical activity patterns for children with disabilities contrast with the literature for typically-developing children. For example, Boddy et al. (2015) found no relationship between gender and amount of physical activity. Lorenzi et al. (2000) observed statistically significantly higher rates of physical activity for girls based on heart-rate, although direct observation revealed no significant differences between genders. Recalling Ridgers et al. (2012), typically-developing boys consistently demonstrated more physical activity than girls. Boddy et al. (2015) suggested that this may be the result of playground design – the playground did not provide “sport” areas that may reinforce gender stereotypes. These authors also found that solitary play corresponded with increased physical activity – this is also inconsistent with literature about children without disabilities, who are generally more active in groups (Roberts et al., 2012).

Social behavior. Children with ASD consistently demonstrated fewer peer interactions on the playground than typically-developing children (Bauminger, Shulman and Agam, 2003; Bingham et al., 2015; Dean, Harwood and Kasari, 2016; Kasari, Locke, Gulsrud, Rotheram-Fuller, 2010; Locke et al., 2016). Given the diagnostic criteria of ASD, this is not surprising. However, in a study of 51 children with ASD and 51 age-matched typically-developing peers at seven inclusive schools, Locke et al. (2016) found significant heterogeneity in children with ASDs’ peer engagement. Though the children with ASD collectively spent less time in social activities than their peers (40% vs 70%), children with ASD did exhibit successful social initiation behaviors. Occasionally children with ASD spent more time engaged socially than typically developing peers. This suggests that, although social difficulties are a hallmark of this disorder, children with ASD are still subject to individual variation.

Less research characterized the social behavior of children with non-ASD ID. Boddy et al. (2015) studied playground behaviors among seventy 5 to 15-year-old children with ASD and

ID using SOCARP. They found that children with both ASD and non-ASD ID spent most of their time playing alone or in small groups (2 to 4 children). Older children spent more time in small groups than younger children. There were no significant differences between boys and girls. No children from either group spent any time in large groups (10+ children), and medium-sized groups were very rare. Although this study provided insight into the social patterns of children on the playground, observers only collected data for 5 to 10 minutes for each child. Longitudinal observations may better account for day-to-day variation in social playground behavior.

Play. There is a paucity of research examining actual playground play for children with ASD and ID. As in typically-developing children, physical activity and social behaviors may be components of play, but they do not fully encompass play. Boddy et al. (2015) captured some elements of play through SOCARP data – they observed that children with ASD and ID in specialized schools spent the most time playing games and less time playing organized sports, walking, or engaging in sedentary activities. However, the authors acknowledged that SOCARP did not provide sufficient depth to understand the chosen play activities of these children. Anderson, Moore, Godfrey and Fletcher-Flinn (2004) observed 10 children with ASD on inclusive primary school and kindergarten playgrounds. They found that children with autism demonstrated fewer socially-complex and developmentally-advanced play activities than their typically-developing classmates, favoring solitary play or unoccupied locomotion. Notably, they observed low play scores and peer interactions in children with a one-on-one aide during free play. This suggested that the presence of adults did not facilitate play engagement. Despite the implication, varying ASD severity and the small sample size limit generalization of this conclusion.

Despite our limited understanding of what happens on the playground for children with ASD and ID, trends suggest qualitative differences in playground behavior between children with and without these diagnoses. These discrepancies may result at least partially because of disability-related factors. Sufficient evidence suggested that children with ID and ASD demonstrate difficulties in the arena of play (Tanta & Knox, 2014). Children with cognitive impairments may demonstrate delayed play skills, limited self-monitoring, and attention. Children with autism may demonstrate play that is both delayed and qualitatively different from their peers. They may demonstrate limited communication skills, stereotyped movements, decreased motor planning, repetitive behaviors, restrictive interests, motor planning problems and decreased social play. For both groups, these limitations may manifest in decreased levels of play, physical activity and social engagement.

Burke's (2012) participatory photographic project provided an alternative viewpoint to the typically deficit-oriented playground literature for children with disabilities. Through photographic scrapbooks, elementary school children produced profiles of what they did on the playground. The study participants were 6-10 years old, and had a diagnosed impairment (cognitive, motor or adaptive). Burke found that what children with disabilities do on the playground was remarkably ordinary: they sought friendships, demonstrated creativity and imagination, and mastered physical challenges.

Adults' Influence on the Playground for Children with ASD/ID

Mounting evidence suggested that environmental barriers also restrict access to play for children with ASD and ID, while supportive environments may bolster play. As with typically developing children, adults play a part in the playground context. Bundy et al. (2011) described the possibility that adults' playfulness influenced the playfulness of children with ASD. This

suggested that skilled adult playmates on the playground may support play engagement. However, in a later publication from the same study, Spencer et al. (2016) described adults' tendencies to stifle play situations when they perceived that the children were at risk. They posited that this tendency may be stronger with children with disabilities, as they are perceived as more vulnerable and less capable than their typically developing peers. Burke (2012) also referenced this sentiment. She concluded that the children in her participatory study "demonstrated a level of capacity and capability that is generally not recognised by carers, parents and teachers" (p. 978).

Playground Interventions for Children with ASD/ID

Given the unique challenges that the recess environment may present to children with ASD and ID, researchers have trialed playground-based interventions to increase children's physical activity, social behaviors and play. Lang et al. (2011) reviewed 15 studies of playground interventions for children with ASD. The most common intervention was peer-mediation, an approach in which typically-developing peers are trained to support positive social behaviors in children with ASD. Notably, the sample sizes of included studies were very small ($N=1-8$); 14 of 15 articles used a single-study design. All 15 studies reported improvement in skills related to play, with emphasis on social and communication skills (13 studies).

Three studies used "appropriate play" as a measure of intervention success (Baker, 1998; Machalicek et al, 2009; Yuill et al., 2007). Their definitions of appropriate play varied widely. One study is particularly questionable: Machalicek et al. (2009) described appropriate play as the use of playground equipment as it was designed (e.g., sliding on the slide) with eyes open and focused. The researchers aimed to decrease challenging behaviors and increase play in 3 students through a regimented, adult-directed activity schedule. Despite their purported success, one

might question whether the behaviors they coded as “appropriate” truly fulfill the criteria for play (Luckett et al., 2007). Meanwhile, Baker, Koegel and Koegel (1998) defined appropriate social play as time spent attending to the game or social activity, playing with other children, following the rules of the game, and not engaging in ritualistic behaviors. The researchers directed games that incorporated perseverative interests of children with ASD. They found that the frequency of these appropriate play interactions increased during the intervention; further, the children retained benefits at a 2-month follow-up without adult initiation. Yuill et al. (2007) focused on social play as well – they measured frequency of solitary, parallel and group play before and after redesigning a school playground to facilitate playful peer interaction. Through a pretest/posttest design, they found that solitary play decreased in favor of group play on the new playground. Because of the small sample sizes and inconsistency in defining play, these studies suggest that playground play of children with disabilities is not well-defined or understood.

While most playground intervention studies of children with ASD rely on pre-test/post-test designs, Kretzmann, Shih and Kasari (2015) recently published a randomized, controlled trial ($N=26$). The researchers trained paraprofessionals to observe the playground, identify children with ASD who were not engaged, and strategically support their engagement. Interestingly, they found that while children’s peer engagement did significantly improve (and maintained improvement) in intervention schools, the adults did not continue to use intervention strategies to identify and support children with ASD in social situations. The authors recommended ongoing support and training for adult staff members on inclusive playgrounds. Strong methodological studies such as this one may generate better playground interventions.

Limitations in the Current Literature

Careful examination of this body of literature suggested several limitations. Across variables, playground observations of children with ASD and ID yielded inconclusive results. These discrepancies may be related to the variety of methods used to assess physical activity, social behavior and play. However, different recess environments may also have contributed. For example, Sit et al. (2007) described recess in specialty schools, while Foley et al. (2008) observed children in an inclusive setting. Although it is not immediately clear if the environment impacted physical activity, this is a reasonable assumption. Hamm's (2006) findings supported this conclusion – she examined correlations between the ToP and the TOES, finding that the environment has a greater effect on children with disabilities than children without disabilities. However, previous research using the same tools suggested the opposite – Bronson and Bundy (2001) found that ToP and TOES scores demonstrated higher correlation in children without disabilities. Although these researchers disagreed on the extent of the role of the environment for these children, they shared a common finding: for children with and without disabilities, there is a relationship between environmental supportiveness and play. Clearly, there is a need for further research to clarify this relationship for children with disabilities.

Second, there is a paucity of research that examined actual participation in outdoor play for children with ASD and ID. As in typically developing children, research about physical activity and social behaviors may inform the nature of playground behavior, but these elements do not fully address what the children choose to do. Despite the shortage of descriptive studies that reflect what children do, there is no scarcity of interventions aiming to *improve* what they do (see Lang et al., 2011). More research about what children do on the playground in the absence of interventions may lead to better ways to promote their play.

Summary and Conclusions

Play taxonomies form a strong foundation for observing what children do on the playground. However, developmental play categories alone cannot account for the complexity of the transactions among players and their play environments. Further, children do not solely play on the playground – much of what they choose to do falls under the murkier category of “non-play.” Although we have strategies to measure elements of what children do (physical activity and social behavior), these strategies alone do not tell us what children really do.

The literature presented here reflects current knowledge about what children do on the playground. Although researchers have elucidated some patterns, many patterns remain elusive. We do not yet understand the impact of the environment, including adults’ behavior, school policies, and the physical context. Further, playground *play* has received less attention than its component parts, both within the mainstream and disability research.

The relative limitations in play-related playground research may be related to the fields of study of the researchers that dominate the research. Examination of the methodologies in the first section of this review suggested that researchers from public health and exercise sciences view the playground as a space for physical activity. Meanwhile, researchers with background in psychology largely focus on peer interactions and social behavior. Although these fields contribute valuable knowledge, their contributions are disjointed – focused individually on the mind or the body. This had led to tenuous, inconclusive results that do not reflect the complex, transactional nature of interactions on the playground.

The playground literature for children with ASD and ID reflects similar limitations – there is little evidence about the role of environments and the actual nature of play for these children. Playground interventions largely focus on remediating or compensating for limited

social skills or negative behaviors related to disability (see Lang et al., 2011). Few studies reported outcomes in play engagement.

I posit that occupational science is the appropriate discipline to fill the gaps within our understanding of what children do on the playground, particularly children with disabilities. By viewing play as an occupation, we resist breaking this complex behavior into its composite parts – we may even be able to unify knowledge generated by other disciplines. In addition, occupational therapists habitually consider role of physical, social and temporal environments in facilitating or inhibiting behavior (AOTA, 2014). As a result, we may be best suited to examine the playground environment. This may be especially important for children with ASD and ID, as such diagnostic factors are unlikely to change (Bundy et al., 2015).

However, occupational scientists (and researchers across disciplines) who seek to affect change on the playground must have a way to measure what children do on the playground. Currently, researchers are limited by insufficient measurement tools that do not characterize the entire picture; instead, they portray discrete elements. Direct observation methods may provide the best starting point for capturing the playground as a whole. Through flexible coding systems, this methodology may allow researchers to study specific, culturally-relevant behaviors unique to the playground environments they seek to characterize.

Journal Article

The multidisciplinary field of play research is replete with interventions aimed toward ‘improving’ what children do on the playground. Public health and exercise scientists pioneered much of this research, usually focusing on increasing the proportion of physically active play through structured and unstructured methods (see Hyndman [2015] for an extensive review). The preponderance of such research has had a focus on reducing rising rates of childhood obesity (Organisation for Economic Co-operation and Development, 2017). Other playground interventions have aimed to combat bullying and increase positive peer social interactions (e.g., Farmer et al., 2017).

A growing body of literature concerns playground-based interventions for children with disabilities. Given the well-documented rise in autism spectrum disorder (ASD) diagnoses in the past several decades (World Health Organization, 2014), it comes as no surprise that many playground interventions were designed to support children with ASD in particular. ASD is a developmental disorder characterized by persistent deficits in social communication and patterns of repetitive, restrictive behaviour, interests or activities (American Psychiatric Association, 2013). Although studies to date have shown promising results for playground interventions, all have had small samples and other methodological limitations (e.g., Kretzmann, Shih & Kasari, 2015; Lang et. al, 2011; Morrier & Ziegler, 2018).

Beyond methodological limitations, researchers who aim to promote play have limited measurement tools equipped to evaluate the efficacy of playground interventions. Measures used in existing studies (e.g., System For Observing Outdoor Play [SOOP; Engelen et al., 2017] and SOPLAY [System for Observing Play and Leisure Activity in Youth; McKenzie, Marshall, Sallis & Conway, 2000]) are useful to quantify particular behaviours on the playground. They are

unable, however, to capture the complex, dynamic transactions among the group of people on the playground and the physical, social, temporal, and cultural contexts in which they play. Within this transaction, we hypothesize that there exist levels of sophistication, where some types of play are harder to achieve than other types of play. We argue that this is the construct that a successful intervention should seek to improve – if a playground-based intervention works, it should create measurable increases in the sophistication of what children do. In a recent publication, Massey, Stellino, Mullen, Claassen and Wilkison (2018) developed the Great Recess Framework – Observation Tool (GRF-OT) to begin capturing the complex relationship between context and playground behaviours. While this tool demonstrates promise in capturing specific playground interactions in the context of safety, structure, and adult supervision, the focus of the instrument is not on play itself, but rather social behaviours and physical activity. The field of play research would benefit from an instrument that provides more detail on the nature of play interactions in context.

Knowing what the children are doing on the playground may prove particularly important for children with ASD. A long tradition of research characterizes children with autism as poor players, particularly in the social and symbolic/imaginary domains of play (Baron-Cohen, 1987; Hobson, Lee & Hobson, 2009; Honey, Leekam, Turner & McConachie, 2007; Jarrold, 2003). Social play deficits are generally attributed to social and communication impairments inherent to the disorder – for example, difficulty understanding nonverbal communication, abnormal social approach or apparent disinterest in peers. The relationship between ASD and imaginary/symbolic play is less clear. We can say with fair certainty that children with ASD do not engage in imaginary play at the same frequency as their typically-developing peers (Wolfberg, 2009). When they do, their play is considerably less novel and flexible. Although differences in play

are well-established in laboratory contexts (e.g., Charman & Baron-Cohen, 1997; Sigman & Ruskin, 1999), there is a dearth of research examining play behaviours in natural contexts. Studies of play on the school playground could enrich our understandings of the mechanisms that underscore play differences in children with ASD. Additionally, playground-based observations can provide information about the contexts that support or diminish play for children with ASD.

The need for a measurement tool to quantify playground play in context for children with and without disabilities underscores the present study. In this study, we hypothesized that the sophistication of what children do on the playground can be measured on an interval scale, so long as an instrument exists with items that can measure this construct. An instrument of this kind could begin to fill gaps in our understanding of children's play and play development, especially for children with disabilities. However, this instrument must meet several criteria. First, the subject of the instrument must be the playground session in its entirety, instead of individual children. This way, the instrument will capture the social nature of children's playground play. Second, the instrument must be observational in nature to capture the transactions among children and the playground environment. Finally, the instrument cannot rely exclusively on developmental trajectories for play behaviour. This criterion is particularly important for two reasons. First, children with disabilities may not follow the same trajectory of play development or patterns of play preferences that typify play for children without disabilities. Further, developmental trajectories alone cannot account for all playground play behaviour – instead, qualities of the playground environment may afford or diminish certain types of play. For example, swing sets and slides may encourage gross motor play and provide little impetus for construction play. Therefore, the instrument should capture types of play along developmental trajectories, but it should not impose a hierarchy based solely on developmental

norms. Currently, no instrument exists that fulfils each of these criteria, leaving play researchers with a dearth of instruments to capture the construct of playground play sophistication.

A Rasch-Analysis-Based Approach

In this study, we proposed that a Rasch-analysis based, observational instrument with items derived from both developmental literature and pilot observations of playgrounds may meet the criteria described above. The instrument, which is a mobile-application designed for a larger study, was developed to measure the impact of a playground-based intervention. The Rasch model is a latent trait model, in which items on an instrument represent observable manifestation of some unobservable trait (often called a construct) (Bond & Fox, 2015). The Rasch model holds two core assumptions: (1) easier items are easier for all test-takers, (2) harder items are easier for test-takers with more of the latent trait than for test-takers with less of the latent trait (Bond & Fox, 2015).

Through Rasch modelling, we established a construct of what children do on the playground, from least sophisticated to most sophisticated. In doing so, we tested the hypothesis that what children do on the playground is a quantitative latent trait that can be measured by a set of items. The ‘test-takers’ in our model are the playground sessions. From our observation tool, we aimed to construct an ordered set of items that measure what children do from least sophisticated (easiest to observe at all sessions) to most sophisticated (only observed during the most sophisticated sessions).

Authoritative voices (Bond & Fox, 2015; Linacre, 2017; Wright & Stone, 1999) in Rasch measurement emphasized that measurement and theory in the human sciences are inextricably linked. Therefore, our initial item set drew from both developmental play theory and pilot observations of the playground environments. Through Rasch analysis, we refined our item

set to those that best represented (both statistically and theoretically) what children do on the playground. Based on the final set of items derived from this analysis, we tested the validity and reliability of data collected using this measure.

Specific research questions related to construct validity included:

- (1) Do individual items correspond with the Rasch model of the latent variable (i.e., do responses on items correlate positively with increased total measure)?
- (2) Do data from 95% of items conform to the expectations of the Rasch model, as measured by mean square fit statistics within an acceptable range?
- (3) Do rating scales within items progress logically and demonstrate sufficient spread across the range of potential scores?
- (4) Is the spread of item difficulties sufficient to capture levels of the latent variable among the sample measured?
- (5) Does the model fit theoretical expectations for playground sophistication (i.e., do relative item difficulties reflect a logical progression from simple to complex)?

Specific research questions related to reliability include:

- (6) Does the model demonstrate sufficient internal reliability, as measured by session reliability index?
- (7) Does the model demonstrate sufficient internal reliability, as measured by the number of strata associated with the observations?

Context of the Present Study: The Sydney Playground Project

The present study is part of a larger study called the Sydney Playground Project (SPP; Bundy et al., 2015), a large multi-site longitudinal trial that investigates a novel intervention for promoting playground play in five Australian primary schools for children with developmental

disabilities (primarily ASD and intellectual disability [ID]). Instead of using a traditional skills-acquisition model, we took an environmental approach to create a two-armed (child- and adult-directed) intervention. Each school participated in an initial two-term control phase to collect baseline data, followed by a two-term intervention phase. An abbreviated description of the intervention follows – full intervention details, study objectives and measurement tools are described by Bundy et al. (2015).

Child-directed Intervention: Loose Parts. We provided schools with loose part, recycled materials to use on the playground environment. These materials complied with Australian standards for safety. In addition, these materials met seven criteria for selection: 1) no obvious play value; 2) encourage cooperative, active motor play; 3) have multiple uses; 4) can be used in challenging, creative and uncertain ways; 5) provide interesting sensory experiences (e.g., from touch or movement); 6) any hazards inherent to the materials can easily be identified and managed by a child; and 7) are, or are made from, recycled or very inexpensive materials. Materials included, for example, tires, crates, boxes and flexible pipes. Throughout the intervention period, school staff were asked to try not to interfere with children’s play activities except if the children were at risk of harm. Researchers maintained and periodically replaced materials.

Adult-directed Intervention: Risk Reframing. Teachers, school staff and parents attended ‘risk-reframing’ workshops. These small-group sessions, facilitated by the research team, focused on the benefits of manageable risk-taking, the consequences of limiting children’s risk, and strategies for creating opportunities for manageable risk-taking. Sessions lasted approximately 1.5 hours. We offered three risk-reframing sessions per school. The first session corresponded with the introduction of play materials. The second session took place

approximately 3-4 weeks after the onset of the intervention. The final session corresponded with the end of the intervention phase.

Methods

Participating Schools

Participating schools were two independent schools for children with developmental disabilities, one mainstream primary school, and two Aspect Schools. Aspect Schools are a network of eight independent schools providing an evidence-informed education program for children on the spectrum. Table 7 contains demographic and descriptive information for each participating school.

Table 7. *Demographic and descriptive information.*

School	1	2	3	4	5
School type	Private independent catholic school	Private	Aspect school	Public school with separate program	Aspect school
Playground Square (m ²)		625	935	12,737	1800
Staff to student ratio on playground	1:12	1:2	1:6	1:30	1:3
Socioeconomic Status	High	High	Low	Low	High
Description of play environment	Large, open grass space available. Two fixed play structures, and occasional loose play materials, including chalk, trolley boards, large bouncy balls.	Two fixed play structures, two sandpits, nest swing, trampoline, ball pit. Surfaces include grassy and soft-fall areas. Loose sporting equipment available.	Shaded, fixed equipment (jungle gym), trampoline, swings, playmats, trampoline. Three fixed statues. Surface is soft-fall material.	Large, fenced play area with both grassy and concrete regions. No fixed equipment available, Painted playground markings. No loose equipment available.	Grassed area with established trees and herb garden. Soft-fall region with fixed equipment, including swingset and jungle gyms. Loose play materials available including bubbles,

					balls, scooters and chalk.
Participating children	41	46	26	20	14
Total children	70	53	26	23	14
Age in years (mean [range])	7.7 (5 – 12)	8.0 (5 – 13)	7.7 (5 – 11)	8.2 (5 – 11)	8.9 (7 – 11)
Gender (female)	11	14	4	2	0

Participating children had autism spectrum disorders and/or developmental disability. Children ranged in age from 5-13 years. All attending children (approximately 300) had access to the loose part play materials. Only children whose parents or guardians gave informed consent completed additional study measures (see Bundy et. al, 2015). However, all children on the playgrounds were observed for this study. Non-participant children were identified as *NPs* and only coded if they were involved in a group play situation with participant children on using the instrument in this study.

Instrument

All objective data used in this study were collected using a built for purpose iPad application modified from the SOPLAY (McKenzie et al., 2000). The application prompts users to answer a series of questions to generate counts of observed playground behaviours. Appendix B contains a detailed list of observation categories, which include types of play and non-play drawn from the work of Pellegrini (2001), Knox (2008), Skard and Bundy (2008) and Linder (2008). Appendix C demonstrates the progression of the question scheme. The raw output of the instrument for each playground observation (i.e., session) is a series of counts for each item.

To use this instrument, researchers divided the playground into four quadrants. During each observation period, a single observer coded all children in one quadrant and then moved in a clockwise direction to the next quadrant. Children who moved between quadrants during

observation may have been scored twice or may not have been scored at all. The observer repeated this pattern for the duration of the recess period.

Procedure

Data were collected by three gold-standard observers who participated in measure development, and by research assistants who were trained and brought to at least 80% inter-rater reliability. Observers collected data on the playgrounds 3-5 days per week for the duration of the study. Observations took place during outdoor morning recess and lunch periods; data were not collected during rainy periods or any recess periods that took place indoors. Observers completed 57-71 observations at each school during the control phase and 71-112 observations during the intervention phase.

Data Analysis

We employed Rasch analysis to transform raw data into interval measures and assess the validity and reliability of data collected using the observation-based measure. As described, the latent trait in our study is ‘what children do on the playground.’ Items and sessions are both measured on a logit-based interval scale. For this analysis, we used the Rasch partial credit model (PCM). The PCM allows for the possibility of multiple rating scales within the same test. We used Winsteps ([Version No. 4.0.1]; Linacre, 2017), a Rasch-specific software program, to analyse all data. In addition to producing the construct, Winsteps provides fit and reliability statistics to analyse the psychometric properties of data collected using the measure.

Creation of a valid Rasch model is an iterative process. Based on gross inspection of the initial count data, we began data analysis using a master rating scale in which a score of 0 corresponded with 0 observations; 1 with 1-3 observations; 2 with 4-6 observations; 3 with 7-9 observations; and 4 with 10+ observations. We also collapsed all non-play categories into a

single item (not playing), as they did not contain enough unique observations to contribute to measurement. We systematically analysed correlations and fit statistics to optimize both the measurement and construct validity of the final model. We began by analysing point-measure correlations for each item to ensure that they progress in the same direction as the overall construct. We examined items with negative point-measure correlations, indicating that these items did not progress in the same direction as the measurement model. Based on this analysis, we eliminated both single and group complex games.

In the Rasch model, infit and outfit statistics indicate how well items and sessions adhere to the unidimensional model (Bond & Fox, 2015). Winsteps generates two kinds of fit statistics, expressed as mean square values (MnSq). Infit statistics are calculated such that persons located closer to the items' difficulty are given more weight than those further away along the latent trait. Outfit statistics are unweighted; therefore, they are more sensitive to outlying scores that often have excess noise. The desired MnSq value is 1.0 (Linacre, 2017) - we considered MnSq values between .5 and 1.5 as acceptable. Based on fit, we examined and removed qualitative items (equality, complexity and engagement in play) and adult-related items.

In accordance with the Rasch partial credit model, we examined rating scales within individual items. We expected positive point-measure correlations for each point within rating scales, indicating monotonic categories. We also expected that categories would be frequently used (≥ 10 times) and spread across levels of measurement. When these assumptions were violated, we considered collapsing rating scales for that item. Ultimately, we collapsed all items to some degree.

After establishing the final item set and rating scales, we further examined evidence for construct validity based on the match between item difficulties and session scores. At this stage

in data analysis, we found that items progressed most logically when we credited sessions as having achieved both group play and single child play if they demonstrated the former. Additionally, we followed a similar procedure for well-established categories of group play (i.e., parallel, associative and cooperative), giving credit for lower types when higher types were observed. This is in line with previous Rasch analyses of developmental measures, and ensures that false zeroes will not impact measurement results (i.e., Avery, Russell, Raina, Walter, Rosenbaum, 2003; Haley, 1992). After this modification, we iteratively trialled returning deleted items; however, these items still failed to fit the model. To establish the internal validity, we re-examined fit statistics of all items.

Next, we examined evidence for reliability based on statistics generated by Winsteps. The session reliability index, analogous to Cronbach's alpha, addresses the ease with which the difficulty of the measures could be reproduced (Linacre, 2017). High item reliability (>.8) indicates that the data set is sufficiently large to establish the item measures with confidence. The session separation index corresponds with the number of levels of performance that the items can discriminate. We transformed separation to strata using the formula:

$$H = \frac{4G+1}{3} \quad (1)$$

where G= separation index and H= strata (Linacre, 2017). We expected to see at least 2.0 strata to establish that observation measures are not the result of measurement error (Bond & Fox, 2015).

Throughout the data analysis process, we referenced developmental play literature and previous observational literature about children on the playground to make sure that the model made sense. In accordance with Parten's (1932) categories of play, we expected solitary play to

be easier than group play, and for group play to progress from parallel, associative and then cooperative play. We established an expected hierarchy of play activities based on analysis of the motor, socioemotional, and cognitive demands as well as literature from play scholars including Pellegrini (2001), Linder (2008), and Knox (2008). Our expected hierarchy, from least to most sophisticated, was: sensory play, art and reading, simple gross motor games, rough and tumble or chase games, construction, joking/teasing/verbal play, imaginary/pretend play and complex games. See Appendix A for a more in-depth review.

Results

We identified 19 items from the observation tool that were productive for measurement and aligned with the unidimensional construct of what happens on the playground. We examined these 19 items for evidence for validity and reliability.

Construct Validity

Table 8 details point measure correlations and item fit statistics for included items. All items demonstrated positive point-measure correlations, suggesting that a higher score on each item corresponded with a higher score on the overall model. Fit statistics provide strong evidence for construct validity; 19/19 included items demonstrated acceptable fit statistics.

Table 8. *Included and excluded items and properties of included items.*

Item	Rating Scale	Measure	S.E.	Infit MnSq ^d	Outfit MnSq	PMC
Cooperative	0-2 ^b	-0.62	0.09	1.19	1.23	0.34
Associative	0-1 ^c	-3.68	0.27	0.98	1.04	0.26
Parallel	0-1	-4.78	0.42	0.91	1.00	0.23
Complex Games (G)	Removed due to negative correlation with overall construct					
Imaginary (G)	0-2	1.45	0.11	0.98	0.93	0.40
Construction (G)	0-1	2.99	0.27	0.99	0.97	0.17
R & T (G)	0-2	0.53	0.1	0.87	0.86	0.55
Simple GM (G)	0-2	-1.36	0.1	0.83	0.80	0.61

A & R (G)	0-1	3.07	0.28	1.03	0.95	0.14
Sensory (G)	0-2	1.46	0.11	1.07	1.18	0.31
J/T/V (G)	0-1	3.43	0.33	1.03	0.94	0.11
Not Playing ^a (G)	0-2	0.35	0.1	1.17	1.23	0.31
Complex Games (S)	Removed due to negative correlation with overall construct					
Imaginary (S)	0-1	-0.32	0.12	0.90	0.86	0.48
Construction (S)	0-1	1.8	0.17	1.07	1.45	0.14
R & T (S)	0-1	-1.18	0.13	0.89	0.84	0.49
Simple GM (S)	0-1	-3.61	0.26	0.90	0.46	0.41
A & R (S)	0-1	1.09	0.14	1.04	0.99	0.28
Sensory (S)	0-1	-1.51	0.14	1.02	1.05	0.35
J/T/V (S)	0-1	2.79	0.25	1.06	1.04	0.12
Not Playing ^a (S)	0-3 ^c	-1.9	0.09	0.97	0.92	0.57
Engagement in play (G/S)	Removed due to conceptual and statistical misfit with hierarchy					
Complexity of play (G/S)						
Equality of social play (G)						
Adults acting as playmates	Removed due to conceptual and statistical misfit with hierarchy					
Adults acting as caregivers						
Adult engagement in play						
Result of caregiver interaction						

^aNot Playing includes aggression, sedentary, walking/running/transitioning, eating, talking to another, onlooker. ^a0,1 rating scale: 0 = 0 observations; 1 = 1+ observations. ^b0,1,2 rating scale: 0 = 0 observations; 1 = 1-3 observations; 2 = 4+ observations. ^c0,1,2,3 rating scale: 0 = 0 observations; 1 = 1-3 observations; 2 = 4-9 observations; 3 = 10+ observations. ^dMnSQ = Mean Square. ^ePMC = Point-Measure Correlation

The original 5-point rating scale proved too broad for all items. For most items, higher categories were used rarely and erratically. Therefore, we collapsed rating scales for all 19 included items, resulting in 10 dichotomous items, 6 three-point items, and 3 four-point items. After collapsing, all items progressed monotonically, so that a lower score on the item corresponds with a lower overall model score.

In the Rasch model, the mean measure for items is set to 0.0 logits. The mean measure for sessions in this sample was -.34 logits. This mismatch may indicate that the test was slightly too difficult for the sample population. However, visual inspection of the item map (Figure 1) reveals

excellent targeting for sessions spanning more than two standard deviations from the mean. We can confidently attribute the mismatch to the four items at the top of the scale (*group joking/teasing/verbal play*, *group art and reading*, *group construction* and *single child joking/teasing/verbal play*) that were Infrequently used during playground observations.

The item map revealed relative congruence with our theoretical hierarchy (see Appendix A). However, some play types diverged from the expected order – *art and reading* and *joking/teasing/verbal play* earned very high measures, while *imaginary play* was lower than expected.

Reliability

The session reliability index was .67 when extreme scores are ignored (model reliability) and .60 when extreme scores were included (real reliability). Per Linacre (2017), the true test reliability falls between these two values. These values fell below our desired of .80, providing limited evidence for reproducibility of measurement. The session separation index is 1.23, which suggested that the measure can reliably categorize observations into 2 categories (high performers and low performers). For a low-stakes assessment where the consequences of misclassification are not dire, a strata value of 2 established adequate reliability (Bond & Fox, 2015).

Discussion

The findings from this analysis suggest that we have created a promising methodology for measuring what children do on the playground. Uniformly positive point-measure correlations, acceptable fit statistics, and monotonic rating scale categories provided excellent evidence for the validity of a unidimensional construct that can be measured on an interval scale. However, optimizing fit statistics and reliabilities was not our goal; instead, we aimed to produce

a logical hierarchy of items that works well enough to measure what we would like to know – what children do on the playground. Per Bond and Fox (2015), Rasch analysis serves best in the presence of a dynamic relationship between theory and practice. In other words, the construct

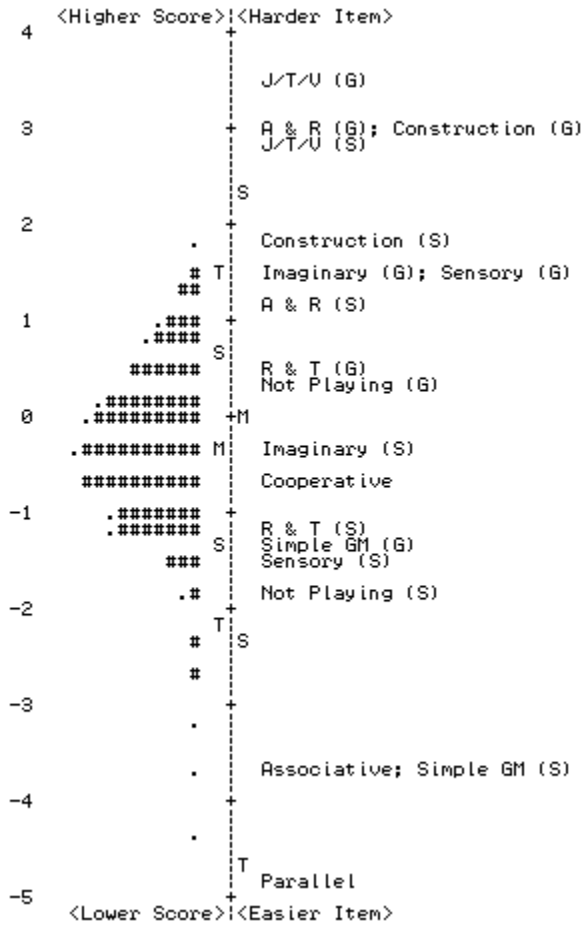


Figure 1. *Item and observation hierarchy map.*

= 3 observations, x = 1-2 observations. M = mean, S = 1 standard deviation, T = 2 standard deviations. (S) = single child or single child with an adult. (G) = group of two or more children. A&R = art and reading; J/T/V = joking/teasing/verbal play. R & T = rough and tumble play.

must make sense theoretically – when it does not, the researcher must examine both the items and the theory. Therefore, the congruence between our theoretical construct and our empirical construct (Figure 1) provided the most important evidence for validity: construct validity. Simple play types, such as *single child gross motor play* and *single child sensory play*,

are easy for any playground to support. From a developmental standpoint, these types of play emerge early in childhood (Knox, 2008; Linder, 2008). For children with ASD, sensorimotor play often dominates longer into childhood (Kangas, Maatta & Uusiautti, 2012). Additionally, the play environments, equipped with sandpits and fixed equipment, supported these types of play. Therefore, their position at the bottom of the hierarchy is logical and suggests good construct validity.

We also found that *single child not playing* emerged lower on the hierarchy than *group not playing*. This, too, meets theoretical expectations for the study population – children with ASD and ID generally demonstrate fewer social behaviours on the playground (Bauminger, Shulman & Agam, 2003; Kasari, Locke, Gulsrud, Rotheram-Fuller, 2010; Locke, Shih, Kretzmann & Kasari, 2016). Therefore, it was not surprising to observe that children with ASD/ID spent lesser time in group non-play situations such as eating or talking as a group. Notably, the difficulty of *group not playing* was only slightly above the mean ability measure, suggesting that children with ASD/ID do engage in some non-play activity on the playground. However, because we collapsed all non-play activities into one item, we cannot be certain that this non-play involved socialization.

There were several deviations from expected results. Perhaps most interestingly, imaginary play was not as difficult as we expected. In fact, we found that single child imaginary play aligned with the mean score of all observations, suggesting that the average playground from our sample could achieve this. *Group imaginary play* was significantly more difficult than *single child imaginary play*, but still occurred in some playground observations. For this instrument, we operationally defined imaginary play as activities that involve an element of pretend, incorporating objects or other people into play in novel, imaginative, unconventional or

variable ways. Observers coded single child imaginary play if a child engaged in any of these activities in the absence of a peer (although an adult may have been interacting with the child). Group imaginary play represented observations in which two or more children engaged in imaginary play in a parallel, associative or cooperative manner, with or without an adult involved.

There is a long tradition of research investigating the differences in imaginary play apparent in children with ASD (see Mastrangelo, 2009; Jarrold, 2003 for extensive reviews), suggesting that their imaginary play emerges later than age-matched peers. If and when they do demonstrate imaginary play, this play takes on a stark, repetitive quality that is less complex and flexible than that of developmentally matched peers (Baron-Cohen, 1987; Charman & Baron-Cohen, 1997; Ungerer & Sigman, 1981; Wolfberg, 2009). Children with ASD do demonstrate the capacity to pretend; however, their pretence is generally limited to imitation of a modeled sequence (Charman & Baron-Cohen, 1997; Jarrold, Boucher & Smith, 1996). Researchers have questioned if these children are truly pretending (Lockett, Bundy & Roberts, 2007). The source of imaginary play deficits is controversial. Some scholars have argued that deficits in symbolic play stem from a cognitive inability to allow one item to represent another (Baron-Cohen, 1987). Others have contended that the deficit lies in generating ideas for play (Jarrold et al., 1996). More recent scholars suggest a connection between social and symbolic deficits – that the child with ASD may not spontaneously engage in symbolic play because they are not intrinsically motivated to do so in the absence of joint attention and shared experience (Hobson, Hobson, Cheung & Calo, 2015; Hobson, Lee & Hobson, 2009).

Very few studies have investigated imaginary play under natural, social and unprompted conditions, as we have in this study. Although some studies investigate ‘spontaneous’ imaginary

play (Libby, Powell, Messer & Jordan, 1998; Hobson, Lee, Hobson, 2009; Kang, Klein, Lillard & Lerner, 2016), these studies still reflect experiment-driven conditions wherein children were given a set of toys in a secluded place. Kangas et al. (2012) conducted play observations of 45 children ranging from under 6 to 16 years of age. They observed occasional episodes of symbolic play in which the children followed a plotline (e.g., pretending to fix a dryer and have a cup of coffee). However, this play was rare, solitary and still retained the repetitive qualities described by previous researchers. Notably, these play observations took place in a 2-week intensive rehabilitation program for children with ASD; therefore, they still do not rise to the level of ‘natural’, per se. Wong and Kasari (2012) systematically observed children with ASD and children with other developmental disabilities in their preschool classroom. However, given the young chronological and developmental age of their participants, this finding added little to our understanding of imaginary play in natural contexts.

Clearly, more natural observation of play behaviours for children with ASD would strengthen our understanding of the nature and source of play preferences, strengths and deficits, particularly in the complex realm of imaginary play. The instrument used in this study allows observers to collect this sort of quantitative data on the playground, a natural context for children’s play. Given the preliminary nature of this study, we hesitated to draw any conclusions about the nature of imagination for children with ASD. First, because adults were coded separately from children, our coding structure did not distinguish children engaged in imaginary play alone from children engaged in imaginary play with an adult. An observation of *single child imaginary* means only that no other *children* were present – an adult may have been engaged with the child, eliciting or joining in on imaginary play. Previous findings suggest that an engaged adult may facilitate imaginary play for children with ASD (Charman & Baron-Cohen,

1997; Jarrold et al., 1996). Therefore, future iterations of this instrument should account for the presence of an adult during imaginary play. Further, although the clear majority of the children had diagnoses of ASD, we do not have diagnostic information on particular children taking part in each observation. It is possible (however unlikely) that all observations of imaginary play could be attributed to those few children with ID and not ASD.

Despite these limitations, our findings underscored the need to better understand the nature of imaginary play for children with ASD. If educators underestimate capacity for imaginary play, they are unlikely to plan for it. Spencer et al. (2016) found that teachers' beliefs about children's lack of capacity for imagination might lead them to stifle valuable play opportunities. Widely accepted beliefs about ASD and other disabilities impact not just children's participation in imaginary play, but in outdoor play in general. In a review, Sterman et al. (2016) found that caregivers of children with disabilities weighed societal attitudes about children with disabilities' capacities as a barrier to participation in outdoor play. The instrument designed for this study may contribute both a deeper understanding of children's capacities and of the types of environments that support children with disabilities. In the long term, such nuanced understanding can contribute to shifts in societal attitudes and expectations for children with disabilities.

Other deviations from our theoretical construct have intuitive explanations. *Single child and group art and reading* emerged as hard items, especially in a group context. At the outset of our study, we conceptualized art and reading as a simpler play activity for primary school children with ASD/ID. However, we had little theoretical evidence for this hypothesis, as most extant measures of play do not include this category. Logically, art and reading are typically solitary activities; actions are relatively predictable and prescribed. During test development at a

single playground, we observed children using chalk with relative ease and frequency. However, the conceptual ease of art and reading did not align with our findings. The most likely explanation is that art supplies and reading materials were not usually on all playgrounds – the play environments, therefore, did not afford these behaviours. We chose to keep this item for several reasons. Despite relative infrequency, art and reading did happen on every playground – it is something that children do on the playground. Conceivably, a very sophisticated group of children engaged in artistic expression on the playground, using sticks or other natural objects. Additionally, the relatively low but positive point-measure correlations suggested that retaining the art and reading items would not threaten measurement. However, this item warrants further investigation in future studies.

Joking, teasing and verbal play were also very difficult, representing item measures outside the range of any observation. Observers coded this behaviour during only 18 of 312 observation periods. There are two logical, non-exclusive explanations. First, the nature of ASD (the primarily diagnosis of our participants) is germane to this discussion. Individuals with autism have persistent deficits in social communication, particularly characterized by difficulty making inferences and recognizing nonverbal communications (APA, 2013). Joking and teasing demand these skills, as well as cognitive flexibility and problem solving. Previous studies documented decreased humor and teasing in this diagnostic group (e.g., Baron-Cohen, 1997; Heerey, Capps, Keltner & Kring, 2004; Lyons & Fitzgerald, 2004). Second, joking, teasing and verbal play were probably difficult for observers to reliably score – a finding consistent with the Test of Playfulness item difficulties (Skard & Bundy, 2008). Observers may not have noticed this sometimes-fleeting type of play if they were not near the players. They may have misidentified

this as not playing, especially if it appeared that children were just talking to each other. Also, children may have ceased these behaviours if they knew an adult was watching.

Neither *group complex games* nor *single child complex games* fit the construct – they demonstrated negative point-measure correlations with the overall construct. That is, as complex games increased, the overall score decreased. This may seem counterintuitive – literature suggests that complex games with rules are among the most sophisticated forms of children’s play (Knox, 2008; Linder, 2008; Pellegrini, 2001). However, in this study, observers coded sports as complex games; indeed, games of soccer accounted for many of the observations of complex games. The time-consuming nature of sports precludes other types of play – in other words, when children engaged in complex games, they were not doing anything else (though they likely were capable). A requirement for Rasch modeling is that items are independent; the outcome of one item should not impact the others (Bond & Fox, 2015). Therefore, we removed this item and acknowledged that this construct is limited to measuring what happens on the playground except for sports. Upon further inspection of the data, we discovered that most of the observations that included complex games occurred at School 4, the only school that had a large, grassy field and mainstream students who played soccer often. Based on this finding, we recommend using this observation strategy with caution on playgrounds where children primarily engage in sports.

Additionally, following consideration, we removed 3 initial items that had underfitting mean-square statistics, ranging between 1.7 and 2. These items represented all the ‘qualitative’ items on this scale - quality of social play, group engagement, group sophistication, single child engagement and single child sophistication. We observed that the children on the playground could be very engaged while participating in very simple play activities; alternatively, they could participate in sophisticated play activities with a relatively unsophisticated approach. We drew

these qualitative items from Skard and Bundy's (2008) Test of Playfulness, a Rasch-based measure that analyses a single child's approach to play. Unlike count variables, these items required raters to score their observations from, for example, low engagement to high engagement. Although we initially believed that these factors would be productive to measurement, underfit in these items seems to confirm that our construct only measured *what* children do on the playground, not *how* they do it. These variables might better represent another construct (e.g., the children's approach to what happens on the playground). Currently, no measurement tool can assess the playfulness of groups of children at once – this warrants further investigation.

Observers also coded three domains of adult behaviour: (1) how they interacted with children – as playmates or as caregivers; (2) if caregivers, the result of the interaction – positive/neutral/negative; and (3) if playmates, how engaged the adults were in the play. We initially intended to include these in the construct; however, after several iterations, it became clear that adults' actions did not consistently fit the construct. The adults could be highly playful and engaged on a low-scoring playground; alternatively, they could be absent (i.e., not in the immediate vicinity) on a playground with a high-score. Conceptually, this aligns with previous mixed findings about adults on the playground. Some studies of typically-developing children suggested that the presence of an adult can increase physically active play (e.g., Willenberg et al., 2010; Sallis et al., 2001), while others found the opposite pattern (e.g., Ridgers, Stratton & McKenzie, 2010; Zask et al, 2001). The variation in adults' influence was likely related to cultural and individual variation (Hyndman, Benson & Telford, 2016). On many Australian school playgrounds, the problem of 'surplus safety' may lead adults to shut down play situations that they perceive as risky (Wyver et al., 2010). Indeed, interviews with children suggested that

they perceive adults' interventions as disruptive to their play (Armitage, 2010). Considerably fewer researchers have analysed the role of adults on playgrounds for children with cognitive disabilities, but (as discussed previously) it stands to reason that adults would be even more inclined to stifle risky play for children they perceive as vulnerable (Spencer et al., 2016). Alternatively, skillful adults could facilitate play for children with ASD/ID (Reed, Dunbar & Bundy, 2000). Our findings suggested a need for further research into the role of adults as playmates and caregivers on the playground for children with ASD/ID.

Limitations

This study represents the first inquiry into a Rasch-based, mobile application instrument for observing what happens on the playground. Although the method has promise, there are limitations to this study. Most notably, we established the psychometric properties based on a relatively homogenous sample. We expected more variation across playground sessions, but we found that, even across schools, the children's playground activities were very similar. Our reliability reflects this limitation – in the Rasch model, sample reliability depends on the length of the instrument, length of the rating scale, match between sample ability and items, and sample ability variance (Linacre, 2017). While our instrument and data met the first three criteria, our sample demonstrates a small standard deviation on the measure. However, our strata indicate that this test can reliably determine two levels of performance, indicating adequate (if not very high) reliability at this stage of measure development. Additionally, our only criteria for interrater reliability was 80% agreement with a single gold-standard observer who was involved with measure development. Due to funding limitations characteristic of most studies of this nature, we relied upon interning students to collect data. Nevertheless, our study would have been strengthened by multiple observers crossing more observations.

Another limitation stems from the presence of non-participant children on the playgrounds. Non-participants were not coded if they were playing without participating children; therefore, it is possible that the playground observations do not give a complete picture of play sessions. However, participation rates were high across schools, ranging from 86-100% in 4/5 schools.

Finally, Rasch-generated measures are based on the theory that all items and all abilities fall somewhere along a unidimensional trait (Bond & Fox, 2015). Due to limitations in the existing research (specifically, the lack of gold-standard observation tools for measuring what children do on the playground), we cannot compare our model of the latent trait to any extant models. Therefore, we can only establish content validity based on interdisciplinary findings about play development, school playgrounds, and the diagnostic groups included in this study.

Conclusions and Recommendations for Future Development

In recent years, outdoor play researchers face increased calls to use rigorous study designs to strengthen the science that underscores our research and intervention (Wyver, Engelen, Naughton & Bundy, 2017). However, effective measurement strategies are prerequisite to rigorous methodologies. The results of this study suggested that this observation-based instrument is a valid method to measure what children do on the playground. We have demonstrated that the items on the measure represent a unidimensional construct. We also found preliminary evidence that the instrument can separate high and low performers. Most importantly, the construct aligns with (and shows the potential to contribute to) contemporary play literature.

Of course, measure development is an ongoing process. Therefore, we recommend further investigation of this instrument, including changes to the coding structure to further

capture the role of adults in playground play sophistication and to re-integrate sports and complex games. Future studies should calibrate this instrument on more varied playgrounds. Additionally, researchers may be interested to know if the construct varies for typically-developing children or children with other disabilities. In this study, we found good congruence with hierarchies of play established for typically-developing children. Further exploration comparing these findings with findings on mainstream playground could determine if this instrument is most appropriate for disability-specific observation or for playground observation in general.

Conclusion

At the outset of this thesis, I referenced children's right to play, established in Article 31 of the United Nations Convention on the Rights of the Child (UNCRC, 1990). Throughout my thesis process, the right to play has been both my beacon and my burden. As an occupational therapist, I am drawn to support children's play. Occupational therapists often describe play as the primary occupation of childhood (Parham, 2008). As Bundy (1993) stated, occupational therapists must take play seriously. We should endeavor to design interventions that measurably enable children to engage in play that they find meaningful and enjoyable. This is particularly true for children with disabilities such as ASD and ID, who may face endogenous and exogenous barriers to play. Through my literature review, I found that occupational therapists and play promoters in general do not have the instruments to assess whether our interventions produce measurable change in play, especially on the school playground. Further, and perhaps more importantly, we do not yet know exactly what children with disabilities do on their school playgrounds. With these gaps in mind, I set out to establish the validity and reliability of an observation-based system to measure playground play for children with ASD/ID.

While my drive to support children's play powered me through the many iterations and reiterations of Rasch analysis and measure development, the same drive presented a paradox. Although scholars agreed that play defies universal definition, they largely agreed on certain characteristics typically associated with this play (Burghardt, 2011; Rubin, Fein and Vandenberg, 1983; Sutton-Smith, 1997, Skard & Bundy, 2008; Smith and Vollstedt, 1985). Play is more internally controlled than externally controlled, more intrinsically than extrinsically motivated, more process-oriented than product-oriented, and more free from than bound to reality. Play is enjoyable and engaging. Based on these characteristics, I struggled with the prospect of

quantifying what children do when they are free to play. By attempting to measure play activities, am I somehow eroding or discounting the qualities of the playground that make it playful? But on the other hand, without a quantitative way to measure how children play, how can I defend their right to do so?

Through critical reflection on my thesis process, I have renewed conviction in the work that I have presented here. In this chapter, I presented this conviction in the form of two arguments. First, that contextual interventions (such as the SPP) may provide the best balance between play provision and child-driven play. Second, that the measurement strategy provided in this study can provide an objective way to measure such interventions. However, through the process of reflection, I did not merely rationalize my dissonance. Instead, I identified a critical area for future research that emerged from the conflict I experienced.

Contextual Intervention: A Promising Way to Promote Play

My conflict is common for those who design interventions to promote play. In their 2010 report, *Play for a Change*, Lester and Russell addressed this challenge directly:

Debates on the level and appropriateness of interventions are dependent upon the particular understanding of the purpose and function of play in any given setting, which range from those who claim that intervention restricts children's ability to explore, take risks or engage in free play, to those who assert that participation shows adult acceptance of play, builds relationships and extends learning. (p. 42)

Wolfberg and Schuler (1993) echoed the same sentiment in the context of teaching play skills to children with ASD: "One of the major challenges in teaching play skills lies in the fact that play is not easily defined in operational terms, and ceases to be play when it is externally

imposed” (p. 468). How, then, should adults provide play to children who may otherwise face barriers to play?

I propose that, through context-oriented interventions, such as the Sydney Playground Project, we can promote play without manipulating or controlling it. The loose, recycled materials on the playground created a physical context that promoted the qualities we associate with play. The children could largely use them in any way they chose. They could suspend reality by pretending a milk crate was a car. They could bounce from one tire to the next. They were in control of their play choices. By educating the playground staff about the value of manageable risk, we aimed to engender a social context that better supported play. By preventing a culture of surplus safety and perceived vulnerability, we hoped that the children could experience more control over their play. They would be free to develop autonomy and intrinsic motivation to play.

Rasch Measurement: A Promising Way to Measure Play

Although this contextual intervention may be sound in theory, we must be able to measure the impact of our intervention. In this study, I presented a strategy to measure, on an interval scale, what children do on the playground. This leads to my second argument: that Rasch measurement is a strong methodology to quantitatively assess the value of contextual interventions. Psychometric scholars described the Rasch model as a tool to assess and revise theories (Bond & Fox, 2015; Wright & Stone, 1999). To use the Rasch model, an instrument designer begins with a set of items that (based on theory) represents a single construct. Through Rasch modeling of raw data, the designer deduces an empirical hierarchy of these items and test the hypothesis that these items measure a quantitative, unidimensional construct. Based on these findings, the test designer returns to his or her theory, and assesses whether the data support or

refute this theory. If the data do not match the theory, either the items do not measure the theoretical construct, or the theoretical construct needs revision.

In this study, I began with a set of items representing the activities that children might do on the playground. These items were based on both play literature and pilot observations of children on the playground. Through Rasch analysis of the pre-intervention condition in the SPP, I found excellent evidence that most of these items represented a unidimensional construct. For cases in which the empirical outcomes diverged from our theoretical outcomes (e.g., imaginary play), I identified areas for growth in both our theory and our measurement strategies. I recommended further calibration of this instrument with other populations. I suggested further naturalistic observation to understand the imaginary play differences observed in children with ASD. Rasch measurement facilitated more than just theory and measure development. Through this approach, I found that the data collected through the observational instrument were valid to establish a baseline to assess the SPP. In the future, these baseline measures will define whether our intervention led to more sophisticated play.

Play-session Playfulness: A Critical Area for Future Research

One finding from this study challenged me more than all the others. Through Rasch modeling, I found that items describing the children's *playfulness* failed to fit the construct (e.g., engagement). These items, drawn from the Test of Playfulness (Skard & Bundy, 2008), operationalized the characteristics of play described previously: namely, internal control, intrinsic motivation, and freedom from reality. Therefore, the results of this study suggested that children's *playfulness* and their *play activity sophistication* are separate constructs. Gross inspection of our data suggested that the misfit stems from the fact that children were, at times, immensely absorbed in the least sophisticated types of play.

Currently, no assessment can measure the playfulness of a play session. Of course, the ToP is useful for measuring a single child's playfulness. However, to measure a contextual intervention, we cannot rely on playfulness observations of every single child. Theory suggests that children would be more engaged in more challenging activities, so long as these activities do not greatly exceed their skill set (Csikszentmihalyi & Bennet, 1971). Unfortunately, without sufficient instruments, we cannot test this theory on the playground. Future research should endeavor to design such a measure.

In conclusion, I contend that if we endeavor to design interventions that promote the right to play for all children, we must evaluate whether our interventions truly fulfill this lofty objective. In this study, I have found that an observation-based protocol may provide a starting point to determine the active ingredients of a successful, context-oriented intervention. The results of this study may suggest future areas for theory development, especially in theories of play development for children with ASD and ID. However, to elucidate the active ingredients of a successful contextual play intervention, we must also know if our interventions lead to increased playfulness.

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Appendix A

Play for Children with ASD: Brief Overview of Literature

Deficits and qualitative differences in play are often considered hallmark characteristics of ASD during childhood (Wolfberg, 2009; Spitzer, 2008). Screening and diagnostic tools designed to identify ASD nearly always contain items related to play behaviors (e.g., Social Communication Questionnaire [Rutter, Bailey & Lord, 2003], Modified Checklist for Autism in Toddlers [M-CHAT, Robins, Fein & Barton, 2009], Autism Diagnostic Observation Schedule [Lord, Rutter, DeLavore, Riski, 2008]). As a result, a number of scholars have theorized about the nature of these play differences. In this section, I briefly summarize the work of these scholars.

Social Play

Children with ASD demonstrate marked difficulty with social play, often associated with pervasive deficits in social communication and interaction skills (DSM-V, 2013). Some children may demonstrate withdrawal or isolation, while others demonstrate frequent failed attempts to initiate or maintain social play (Spitzer, 2008). As in symbolic play, there are competing theories for restricted social play apparent in autism. Most scholars identified skill deficits as the source of limited social play. For example, Sigman and Ruskin (1999) connected limited verbal, nonverbal and joint attention skills to lower instances of social play. Conversely, however, Chavellier et al. (2012) presented a social motivation theory, which suggested that individuals with autism may lack biological drives that compel typically-developing children to engage in social play. As a result, they seek out fewer opportunities to engage in social behavior, and therefore demonstrate downstream social cognitive deficits. However, abundant literature (e.g., Causton-Theoharis, Ashby, and Cosier, 2009; Wolfberg, 2009) indicated that children with ASD

experience loneliness and desire to engage in social play, lending doubt to theories of social motivation.

Imaginary/Symbolic Play

Imaginary/symbolic play deficits also run in tandem with ASD diagnosis. Scholars (e.g., Mastrangelo, 2009; Sigman & Ruskin, 1999) agree that symbolic play emerges later, if at all, in children with ASD than in their age-matched peers. When they do demonstrate symbolic play, this play takes on a stark, repetitive quality that is less complex and flexible than that of developmentally matched peers (Baron-Cohen, 1987; Charman & Baron-Cohen, 1997; Ungerer & Sigman, 1981; Wolfberg, 2009). When an adult elicits imaginary play, some children with ASD do demonstrate the capacity to pretend; however, their pretense is generally limited to imitation of a modeled sequence (Charman & Baron-Cohen, 1997; Jarrold, Boucher & Smith, 1996). Naturally, one might question if these children are truly absorbed in imagination, or if they are just following a learned sequence (Luckett, Bundy & Roberts, 2007).

Despite the evidence for this play difference, the source remains enigmatic. Baron-Cohen (1987) and Leslie (1987) argued that deficits in imaginary play stem from a cognitive inability to allow one item to represent another (metarepresentation). They found that children with ASD spontaneously engaged in functional play (using an object as it is intended to be used [e.g., brushing a doll's hair with a hairbrush]), but they do not spontaneously exhibit symbolic play (using an object in a novel way [e.g., using the doll's hairbrush as a microphone]). They connected these findings to a broader "theory of mind" – that individuals with ASD do not attribute mental states to themselves or to others, resulting in pervasive social and cognitive deficits. Jarrold et al. (1996) contested this interpretation, suggesting that the deficit lies in executive functioning skills. More specifically, they inferred that children with ASD have

difficulty generating ideas for play. Their assertion stemmed from the fact that children with ASD engage in pretend play when prompted. Further, they recognize when others are pretending, lending doubt to the metarepresentational hypothesis (Kavanaugh & Harris, 1994). Recently, scholars suggest a connection between social play and imaginary/symbolic play deficits (Hobson, Hobson, Cheung & Calo, 2015; Hobson, Lee & Hobson, 2009; Kasari, Chang & Patterson., 2013). They contended that that the child with ASD may not spontaneously engage in imaginary play because they are not intrinsically motivated to do so in the absence of joint attention and shared experience that characterizes imaginary play for typically-developing children. Jordan (2003) also connected symbolic and social play deficits. She suggested a transactive relationship between social-emotional and cognitive deficits inherent to autism that leads to a “cycle of impoverished play opportunities” (p. 347).

Conclusions

There is little doubt that children with ASD experience barriers to social and imaginary/symbolic play. However, the source of these deficits remains hazy. Notably, many of the studies described above took place in clinical or heavily structured contexts (e.g., Baron-Cohen, 1987; Jarrold et al., 1996; Sigman & Ruskin, 1999). We know much less about how these children play under the unprompted, social, and natural conditions presented on the playground. Observation in natural contexts may strengthen the body of knowledge surrounding children’s play. Although we cannot infer the source of characteristic play deficits based purely on observation, we can glean a better understanding of how these differences “play out” on the playground.

Appendix B

Theoretical Item Hierarchies

To generate the items used in this measure, we drew from Parten's (1932) categories of social play behavior. We also drew from categories of play types described by Linder (1993; 2008) and Knox (2008). Observers categorized all play into solitary or group play; group play was further divided into parallel, associative or cooperative play. As a result, the instrument generated counts of single child play and group play for each play type (i.e., single child sensory play and group sensory play), and unique counts of all instances of parallel, associative, and cooperative play with other children. Given the extensive literature supporting Parten's (1932) hierarchical organization (i.e., Knox, 2008; Rubin, 2001), we chose to give credit for less sophisticated social play types when the most sophisticated type was present (i.e., parallel play if associative play present). Additionally, we gave credit for single child play types when the group play type was present, assuming that if a child could engage in (for example) sensory play in a group, he or she could engage in sensory play alone. Observers also coded qualitative observations of children's play (engagement, equality, and complexity), and adult behaviors (role of the adult, engagement of the adult, and outcome of the adult interaction). Table 9 contains our established hierarchy for social play levels, as well as our operational definitions and playground examples (Ragen & Beetham, 2016). Table 10 contains our hypothesized hierarchy of play activities, based on both developmental literature and pilot observations of the children at play. Table 11 contains the non-play categories in no particular order, though we hypothesized that group non-play would be more difficult than single non-play. Table 12 contains codes for qualitative items drawn primarily from the Test of Playfulness (Skard & Bundy, 2008), along with operational definitions for each level. Table 13 contains adult-related items and codes.

Table 9. *Social Play Categories and Operational Definitions.*

	Play Category	Definition	Examples
Less Sophisticated ↓ More Sophisticated	Single Child Play	Child plays alone with no effort to engage with other children	<ul style="list-style-type: none"> - Swinging alone - Building a rock structure
	Parallel Play	Children play adjacent to each other, engaging with the same toys or activities, but without dependent interaction	<ul style="list-style-type: none"> - Two children making mudpies in the same mud - Group of children drawing different pictures with chalk
	Associative Play	Children engage in a shared activity, but children do not share a common goal – each child looks out for his or her own play interests	<ul style="list-style-type: none"> - Taking turns crossing the monkey bars - Sharing tools while building separate sandcastles
	Cooperative Play	Children engage in a shared activity with a common goal – children work together or they may take on different responsibilities	<ul style="list-style-type: none"> - Playing tag - Duck-duck-goose - Group of children drawing a hopscotch path together

Table 10. *Play Types and Operational Definitions.*

	Type of Play ^a	Definition	Examples
Less Sophisticated ↓	Sensory Play	Exploratory play with objects or materials where the main objective is the sensory experience (process-oriented)	<ul style="list-style-type: none"> - Playing with water - Playing with mud - Filling containers with sand
	Art & Reading	<i>Art</i> : expression of creativity in visual/musical format <i>Reading</i> : reading out loud or to self	<ul style="list-style-type: none"> - Coloring - Reading books - Singing - Playing musical instruments
	Simple Gross Motor Play	Tasks that involve a single decision followed by a sequenced response; movement-oriented play, often on fixed equipment	<ul style="list-style-type: none"> - Sliding on slide - Climbing trees - Skipping - Throwing and catching a ball
	Rough & Tumble or Chase	Energetic play that may appear to be aggressive expect for the playful context; often involves physical contact	<ul style="list-style-type: none"> - Wrestling - Chasing - Tickling
	Construction	Play that involves using materials or objects to create something new (product-oriented)	<ul style="list-style-type: none"> - Building a rocket ship from milk crates - Using sticks and leaves to build a fort
	Joking/Teasing/Verbal Play	Play that involves creative use of language	<ul style="list-style-type: none"> - Telling jokes - Chanting games - Playful teasing
More Sophisticated ↑	Imaginary/Pretend Play	Games or activities that incorporate an element of pretend; the rules of reality are suspended	<ul style="list-style-type: none"> - Pretending to be a dog - Using a stick as a magic wand - Rocking a doll to sleep
	Complex Games with Rules	Activities or games that involve preset rules, roles and purposeful action; may involve negotiation of rules; often sports	<ul style="list-style-type: none"> - Playing soccer - Playing red rover - Playing freezetag

^aTypes of play were categorized as group or single-child. Single-child may represent either a child alone or a child with only an adult.

Table 11. *Non-play types and operational definitions.*

Type of non-play ^a	Definition
Aggression	Non-playful teasing, name calling, yelling, hitting, pushing, shoving, fighting.
Sedentary	Non-activity with no obvious energy expenditure (e.g. sitting/standing/doing nothing).
Walking / running / transitioning	Moving in or through the space either for the sake of movement or transition. Walking or running to get from one destination to the next. Aimless wandering.
Eating	Eating is the primary activity
Talking to another	This includes verbal (words) and non-verbal (gestures, mime) communication, non-play talking to another child or adult.
Onlooker	Child watches the play of others but does not participate actively E.g. a child on the outskirts of a group building a fort but not verbally or physically participating.

^aNon-play types were further categorized as group or single-child. Single-child may represent either a child alone or a child with only an adult.

Table 12. *Descriptive items drawn from the Test of Playfulness.*

Item	Categories			
Complexity of Play (imaginary and construction only)	<p>Very Simple <i>Imaginary:</i> pretend situation is not at all convincing to observer (e.g., talking to self)</p> <p><i>Construction:</i> making something using fine dexterity skills with no obvious goal</p>	<p>Simple <i>Imaginary:</i> pretend situation is mildly convincing (e.g., uses a prop or costume but not playing out role; repetitive pretending)</p> <p><i>Construction:</i> stacking objects on top of each other with no obvious structure</p>	<p>Moderately Complex <i>Imaginary:</i> pretend situation is moderately convincing (e.g., uses prop or costume purposely)</p> <p><i>Construction:</i> Building and moving materials in an effort to make a structure which requires a few pieces of equipment</p>	<p>Complex <i>Imaginary:</i> pretend situation is highly convincing (e.g., player takes on a full role, plotline is evident and evolving)</p> <p><i>Construction:</i> Building and moving materials to make a structure which requires multiple pieces of equipment and which has the potential to be used as a piece of play equipment after completion</p>
Quality of Social Play (group play only)	<p>Not Equal at All Children are focused on meeting own needs rather than enabling others to play, or is so passive that playmates are primarily using player. Child does not let others know how to interact with them. They do not respond or they respond in a negative or hurtful way.</p>	<p>More Unequal than Equal Children inconsistently supports playmates' play. Give cues that difficult to read. Sometimes disrupt the play. Players respond inconsistently even in situations where play cues seem clear.</p>	<p>More Equal than Unequal Children are reasonably consistent about supporting the play of others but attempts may seem awkward. Give cues that are generally clear but may be occasionally misinterpreted (e.g. verbal and bodily cues do not match). Players respond to cues in a manner that promotes play even in situations where cues may be ambiguous or not to their liking.</p>	<p>Play as Equals Children skillfully and spontaneously enable playmates to play as well as possible. Cues are easily recognized. Responses do not seem strange to playmates. Player responds easily and naturally to others' even when play cues may be ambiguous or not to the player's liking. Children negotiate, compromise, share and take turns.</p>
Engagement in Play	<p>Minimal Engagement Child is not interested at all in task and easily distracted, lacks focus or concentration.</p>	<p>Somewhat Engaged Child engages in several short disconnected play themes. Greater level of interest but</p>	<p>More Engaged than not Child maintains the same play theme with minimal distraction. Participating in</p>	<p>Very Engaged Play is all absorbing. Child is so focused on activity that he/she isn't aware of</p>

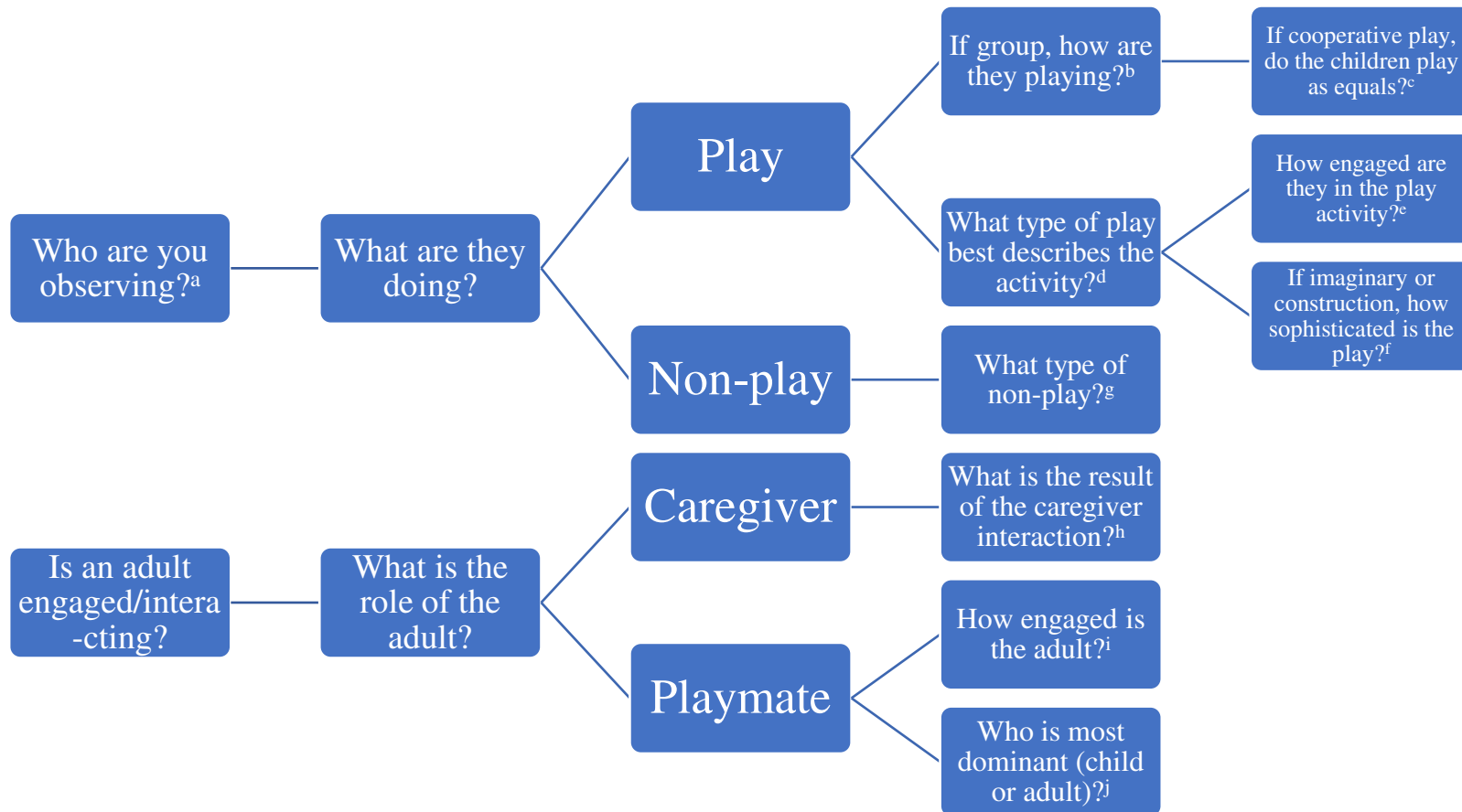
Item	Categories			
	May change play activities quickly and frequently	still distracted easily.	the activity completely but it is likely to be distracted if something else was to grab their interest	surroundings. Ignores other distractions, high level of concentration on activity.

Table 13. *Adult variables.*

Item	Categories			
Adult Interaction (type)	Playmate Adult exhibits playful language, laughing, having fun. Involved in the game or activity with the child/group (even if not overtly having ‘fun’).		Caregiver Adult is interacting but as a caregiver, supervisor or to ensure safety or enforce rules.	
Adult Interaction (engagement – scored for playmate only)	Minimal Engagement	Somewhat Engaged	More Engaged than Not	Very Engaged
Adult Interaction (outcome – scored for caregiver only)	Positive Play Outcome Adult involvement promotes or enables the play. Play continues after the adult interaction.		Neutral Play Outcome An adult is interacting with the child or group of children in some way, but is not influencing the outcome of play. There is no change to play after the adult interacts.	Negative Play Outcome An adult restricts or stops the play. Play stops after adult interaction.

Appendix C

Coding Schema for Observational Measure



^aSingle child/single child with an adult, group of children. ^bParallel, associative, cooperative. ^cNot equal at all, more unequal than equal, more equal than not, play as equals. ^dComplex games, imaginary/pretend play, joking/teasing/verbal play, construction, rough and tumble or chase, simple gross motor game, art and reading, sensory play. ^eMinimal engagement, somewhat engaged, more engaged than not, very engaged. ^fVery simple, simple, moderately complex, complex. ^gAggression, sedentary, walking/running/transitioning, eating, talking to another, onlooker. ^hPositive play outcome, neutral. play outcome, negative play outcome. ⁱMinimal engaged, somewhat engaged, more engaged than not, very engaged. ^jAdult, child, both equal.