Children’s Social Competence, Physical Activity, and Early Engineering Thinking in the Imagination Playground™, Traditional Playground, and Dramatic Play Area

Final Report to KaBOOM!

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Abstract

Researchers at Purdue University observed preschool-aged children at play in three play settings: the Imagination Playground™, the Traditional Playground, and the Dramatic Play Area, in order to compare the occurrence of social, physical, and engineering play in each play context. This observational study included 68 children (30 girls; 38 boys) observed in a Head Start Center and in the Purdue University Laboratory Preschool during 3 ½ months in the spring of 2013. The Imagination Playground™ provided unique opportunities for play. Compared with the other two play settings, children in the Imagination Playground™ displayed significantly more early engineering play, large muscle movement, constructive play, and parallel play. Play in the Traditional Playground featured large muscle movements and functional play. In the Dramatic Play area, children’s play included high levels of fine motor movement and pretend play. While all three play settings offer unique and valuable play opportunities, Imagination Playground™ is unique in facilitating play experience that includes both high levels of body movement and an opportunity to engage in and understand construction and the basic engineering design process.
Introduction

Unstructured free play with blocks and other “loose parts” is thought by early educators to provide young children with unique opportunities to build positive relationships and facilitate early learning, physical development, and school readiness skills. There has been some research documenting the effects of play with wooden unit blocks and other smaller building materials. Block play has been linked to academic success in mathematics (Wolfgang et al., 2001), spatial abilities (Casey et al., 2008), and literacy skills (Stroud, 1995). However, there has been little or no research that systematically describes young children’s engagement and play behaviors with large, easy-to-handle blocks like those available in the Imagination Playground™. The Imagination Playground™ blocks may offer unique opportunities for young children to cooperate and collaborate with others, engage in vigorous and beneficial physical activity, or develop early interests and skills in the engineering design process, when compared with other more traditional preschool play activities. This research was designed to document children’s play in the Imagination Playground™ and other play contexts that are typically found in early childhood programs.

In August, 2012 the Purdue University research team led by Dr. Jim Elicker, the Ben and Maxine Miller Laboratory Preschool at Purdue, and the Lafayette Head Start program were invited to engage in a collaborative research project funded by KaBOOM! The overall goal was to systematically study young children’s play in the Imagination Playground™. The specific objectives of this research were to:

1. Document the early engineering, physical, and social behaviors of young children (3 to 5 yrs.) as they engaged in free play with the Imagination Playground™.
2. Explore the learning potential of Imagination Playground™ blocks compared with other play materials by describing play behaviors of children as they engaged in free play a) with the Imagination Playground™; b) on the traditional outdoor playground; and c) in the indoor dramatic play area.
3. Explore similarities and differences in girls’ and boys’ play with the Imagination Playground™ materials.
4. Provide a report detailing results of this research for the Imagination Playground’s™ developers and educators, including a summary abstract reviewing the findings and implications, and also publish results of the study in the scientific literature.

The research project began in the autumn of 2012 with the development of the observation instruments; training, practice, and reliability testing of data collectors; recruitment and orientation of participating preschool programs and teachers; and recruitment and informed consent with children and families. KaBOOM! provided full sets of Imagination Playground™ blocks and a teacher orientation session for the two participating preschools: The Ben & Maxine Miller Child Development Laboratory Preschool at Purdue University in West Lafayette, Indiana, and the Bauer Family Resources Head Start Program located at Durgan School in Lafayette, Indiana.

Research observations began at the two preschools in early February, 2013 and continued through mid-May, 2013. This report summarizes the methods used to conduct this research, the findings of the research, conclusions, and implications for early childhood education programs.
Research Method

Participants

Children between 3 and 5 years were recruited using parent letters to all families in four classrooms in the Purdue Lab School and four classrooms in the Head Start Center. Parents were given a written explanation of the study and a detailed consent form. Spanish, Chinese, or Korean versions of these materials were provided upon request for families whose primary language was not English. Participation rates were high. Overall, among families invited, 56% of children in the Purdue Lab School and 42% of children in the Head Start Center returned signed consent forms from parents agreeing to participate. Due to time limitations and absences, some of the eligible children could not be observed for the required amount of time for the study. Ultimately, 30 children (10 girls; 20 boys) were observed in the Purdue Lab School, and 38 children (20 girls; 18 boys) were observed in the Head Start Center in three play settings: 1) the Imagination Playground™, 2) the traditional playground, and 3) the dramatic play area.

Observation Procedure

Two research observers visited each preschool classroom on a regular schedule each week, so that they could see all of the participating children engaged in free play in the three play settings. During each observation session, the observer focused on one child at a time and documented all of the social, physical, and engineering play behaviors the child displayed. Observation intervals were 20 seconds: the observer watched the child carefully for 20 seconds, then took 20 seconds to note all behaviors that occurred on a checklist that included 31 social behaviors, 30 physical behaviors, and 9 early engineering behaviors. (See Appendix for the complete observation instrument.) This observation process was repeated for as many intervals as possible during each observation session, ending when participating children stopped playing in the target play area. The total observation time for each child, spread over 3½ months, ranged from 5 to 41 minutes, with an average of about 24 minutes of observation per child. Through the entire study, children were observed playing for a total of more than 1620 minutes (27 hours.) Because the number of minutes each child was observed in each play setting was not exactly the same, we calculated each child’s rate play (# of times observed per hour) rather the simple frequency of occurrences. Using these play behavior rates makes the summary of observed play behaviors in each play setting more comparable and understandable.

Observation Measures

The Purdue research team used structured observation measures to provide comprehensive descriptions of children’s play behaviors in three domains: social competence; physical activity; and early engineering. Observers were trained using both filmed and live practice observations and demonstrated a high degree of reliability on the observation instrument before any data were collected. Each observation measure was derived from instruments had been used successfully in previous research. The combined observation instrument included a total of 70 individual play behavior categories. (See Appendix for categories and definitions.) As children were observed, each play behavior was noted as present or absent within each 20-second observation interval.
Social Behaviors. The categories for social play behavior included measures used in previous research by Susanne Denham at George Mason University and Carollée Howes at UCLA. The two main social play categories included 11 categories of positive, competent play with other children (for example: takes turns, cooperates, and shares) and 10 types of negative, less competent play (for example: hits, shoves, knocks over, throws objects or displays interpersonal aggression; Denham et al. 2012). We also rated the social and cognitive complexity of play using two ordinal scales (Howes, 1980) that include the following categories: 1) solitary, parallel, associative, and cooperative play; and 2) functional, constructive, dramatic play, and games with rules. For each child, summary scores for each social behavior were calculated indicating the average number of behaviors that occurred per hour. The hourly rates of positive and negative social behaviors and the average levels of social and cognitive play complexity levels were also computed.

Physical Behaviors. Categories for physical play behavior included gross motor movement (27 categories) and fine motor movement (3 categories.) The gross motor categories were adapted from a measure of children’s physical activity developed by Gallahue and Ozmun (2006). Summary scores for each physical behavior for each child were calculated, indicating the average number of behaviors that occurred per hour. The hourly rates of total fine motor and total gross motor social behaviors were also computed.

Early Engineering Behaviors. Play behaviors consistent with the basic engineering design process were observed using a nine-category system developed by Demetra Evangelou and colleagues at Purdue University (Bairaktarova et al., 2011). The categories are: 1) communicates goals; 2) design and construction; 3) problem solving/replication; 4) expresses creative/innovation idea; 5) solution testing/evaluating design; 6) explanation of how things are built/work; 7) following patterns and prototypes; 8) logical mathematical thinking; and 9) use of technical vocabulary. Summary scores for each engineering behavior category for each child were calculated, indicating the average number per hour.
Results

Play in the Imagination Playground™, Traditional Playground, and Dramatic Play Area

Early Engineering Play

There were statistically significant differences in the occurrence of early engineering behaviors in the children’s play in the three play settings. The average rates of early engineering play in each setting are shown in Figure 1. Imagination Playground™ provided the context for the highest rate of engineering behaviors observed, approximately 8 times per hour for the average child, followed by the Dramatic Play Area at 6 times per hour, and the Traditional Playground at 2 times per hour. The most frequently occurring engineering behaviors in the Imagination Playground™ were: design and construction, creative idea, and explaining how things are built. Dramatic Play and Traditional Playground had similar types of early engineering behaviors, but at significantly lower levels compared with Imagination Playground™.

![Figure 1. Number of times/hour, early engineering play as a function of play setting](image)

Physical Activity

Play is active! The observations revealed that children were engaged in frequent fine motor and gross motor behaviors in all three play settings, but the relative amounts of physical activity were significantly different across the settings. (See Figure 2.) For these whole body gross motor movements, the Imagination Playground™ was by far the most active, with an average rate of 24 occurrences per hour for the average child. This was twice the rate of gross motor behaviors observed on the Traditional Playground, and more than three times the rate of gross motor behaviors observed in the Dramatic Play Area. The most frequently observed gross motor behaviors in the Imagination Playground™ were walking, bending, dragging/carrying a large object, lifting a large object, and ascending/descending. In the Traditional Playground the most frequent gross motor behaviors were walking, running, bending, biking/scooter, and ascending/descending, and in the Dramatic Play Area the most frequent gross motor behaviors were walking, holding more than one object, carrying a small object, bending, and dragging/carrying a large object. When we observed fine motor movements, not surprisingly the
highest frequency, 44 occurrences per hour, was seen in the Dramatic Play Area, which is an indoor play area with many small objects for children to manipulate. In the Imagination Playground™ we observed fine motor behaviors at the rate of 16 per hour, and in the Traditional Playground we observed 11 fine motor behaviors per hour for the average child. The most frequent fine motor behaviors in the Dramatic Play area were manipulating, drawing/painting, and writing. In the Imagination Playground™ and the Traditional Playground, children engaged in similar fine motor movements, but at considerably lower rates than in the Dramatic Play Area.

**Social Competence**

Both positive and negative social behaviors in the children’s play were observed. In all three play settings, positive social play behaviors far outnumbered negative social behaviors, at a ratio of 15 per hour to one per hour. There were no differences in these behaviors across the three play settings; the average rates were not significantly different. The most frequently observed positive social play behaviors were: engages in independent activity (11.31 times per hour), displays positive affect (4.57), cooperates (1.64), plays with opposite gender (1.37), positive affect towards another (.83), and leadership (.75).

When we examined the social and cognitive complexity of play, differences in play settings were apparent. The observed rates of the social play categories are shown in Figure 3. In general, parallel play was seen most often— in which two or more children are playing side by side, doing similar activities, yet not interacting. Associative play, in which children share play materials, was next in frequency, followed by solitary play, and the least frequent was the most complex and least-observed level, cooperative play. With the exception of parallel play, none of these play levels were statistically significantly different across the three play settings. The average rate of parallel play was highest in the Imagination Playground™, significantly lower in Dramatic Play, and still lower in the Traditional Playground. Possible reasons for this pattern of parallel play are discussed in the Conclusions.
Examining the cognitive complexity of social play, we categorized four types: functional (physical), constructive (building or making), dramatic (pretending), and games with rules. (See Figure 4.) Games with rules rarely occurred, as might be expected in preschool-age children in these types of play settings. For the other three types of play, each play setting provided clear and sometimes unique opportunities. We did observe some level of functional, constructive, and dramatic play in each play settings, however the relative amounts varied. Functional play, characterized by doing some physical action afforded by a toy or other play equipment (e.g., going down a slide) was seen most often in the Traditional Playground. Dramatic play (pretending) was seen most often in the Dramatic Play Area. Constructive play was seen most often in the Imagination Playground™, at about twice the rate of constructive play in the Dramatic Play Area, and ten times the rate seen in the Traditional Playground.
Comparing Girls’ and Boys’ Play in the Imagination Playground™

We compared the frequency of all types of play in boys and girls as observed in the Imagination Playground™. Remarkably, for the most part, there were not significant differences in girls’ and boys’ play behaviors in this unique play setting. Girls exhibited early engineering play behaviors at the same rate as boys. Likewise, rates of physical behaviors were very similar. The average rates of gross motor and fine motor behaviors were slightly higher for boys, but these differences were not statistically significant. There was a small but significant difference in positive social behaviors, with girls at an average rate of 16 times per hour and boys at an average rate of 14 times per hour. Negative social behaviors were very low overall in the Imagination Playground™, with no significant differences between girls and boys.

Comparing Play in Head Start Center and University Lab School in the Imagination Playground™

Children in the Head Start program mostly come from families whose annual income is below the U.S. poverty level. Children in the Purdue University laboratory school primarily have parents who are university faculty, staff, or students. Therefore, one might expect that the Lab School children would perform at a higher level in some areas, due to differences in socio-economic status and other family characteristics. However, few differences in play behaviors in the Imagination Playground™ were observed when we compared these two program settings. Overall rates of early engineering behaviors and fine- and gross motor activity were statistically the same in Head Start and the Lab School. When examining social behaviors, we found that the Head Start children had higher average rates of both positive and negative social behaviors in the Imagination Playground™ than did Lab School children. The differences in negative behavior were not statistically significant. For positive social behaviors, Head Start children had an average rate of 16 per hour, University Lab School children had an average of 13 per hour, and this was a small but statistically significant difference.

Discussion & Conclusions

The goal of this observational study was to compare preschool children’s play behaviors in three distinctive play settings: the Imagination Playground™ (large, sturdy, lightweight blocks); the indoor dramatic play area (housekeeping/domestic toys and other pretend play materials); and the traditional outdoor playground, with its tricycles and fixed play structures. Observations and careful comparisons of children’s spontaneous play in these settings should suggest what specific play and learning opportunities each setting affords. We conducted extensive observations of the children’s social, physical, and engineering play in these three play settings. The results show clear patterns of difference in frequencies of different types of play in each setting.

In the Imagination Playground™, children displayed the highest rates of early engineering play, gross motor movements, constructive play, and parallel play. In the Dramatic Play Area, children displayed the highest rates of pretend play and fine motor activity. In the Traditional Playground, children displayed the highest rates of functional play, that which is primarily physical and structured by the designed function of the play equipment. Across all three play contexts, children in both Head Start and the university laboratory school displayed high rates of positive social play behaviors, and low rates of negative social behaviors.
Clearly, each of these three settings offers children a range of play opportunities, and the spaces and materials available in each setting afforded unique and valuable play and learning experiences. Two of the play settings, the Traditional Playground and the Dramatic Play area, have been mainstays in preschool education in the United States for more than 100 years. The Imagination Playground™ is new on the early education and recreation scene, so this study is the first effort to systematically describe how young children play with these unique large, moveable blocks and also to compare play in the Imagination Playground™ with other more traditional preschool settings and materials.

This research shows that Imagination Playground™ offers a high level of play opportunity in several important developmental domains. In the social domain, Imagination Playground™ provides a context for developing social competence that is at least equal to dramatic play or traditional playground play. Imagination Playground™ offers a high level of opportunity for a wide range of whole body, large muscle movements, including walking, bending, dragging/carrying large objects, lifting large objects, and ascending/descending structures. It might be surprising to some that when children played with the Imagination Playground™, their overall level of gross motor movement was higher than on the Traditional Playground, with its swings, slides, and tricycles. Also, opportunities for conceptualizing problems, setting goals, planning, designing, constructing, and evaluating constructive work-- true early engineering skills-- were significantly increased in the Imagination Playground™, when compared with the other play settings. Moreover, these opportunities were equally accessible to girls and boys, and to children in Head Start and the University Lab School. The amount and complexity of play in the Imagination Playground™ generally did not differ across gender or socio-economic group, so we conclude that the play and learning opportunities afforded by the Imagination Playground™ will be accessible to children with a wide range of backgrounds. Based on our observations, we suggest that Imagination Playground™ would be a valuable addition to the curriculum of any program serving young children.

It is important to point out that, just as with any research study, there are limitations with this one. We observed only 68 children attending two preschools in the American Midwest, so these results will not necessarily generalize to all young children. Also, while we used structured, research-validated methods to observe children’s social, physical, and early engineering play behaviors, so we did not observe other aspects of play that may be of interest; for example, use of mathematics, leadership, or complexity of language. Lastly, this was not experimental research; it involved naturalistic observation and description, so it is not possible to conclude with confidence any causal effects that the play settings had on the play behaviors we observed. Other factors that we did not observe may have played a role in the patterns of play behaviors reported here.

Despite these limitations, we predict that the patterns of play we observed in these particular children in these settings will be found in future research in other locales, with children of varying backgrounds. These results document with a high degree of reliability the kinds and amounts of play we saw in the Traditional Playground, Dramatic Play Area, and Imagination Playground™. The results will reinforce strongly held beliefs among early educators and child advocates that play is valuable for all children, and that children need and deserve a variety of play settings and active play opportunities in order to experience a rich life and optimal development. The Imagination Playground™, with its wide variety of large, moveable “loose parts,” open up new and exciting play opportunities for young children, stimulating engineering thinking, whole body movement, and social competence with peers. We hope these findings will stimulate greater opportunities for young children to play with large, “loose parts” and also will stimulate more research on its potential benefits.
References


