

The Effects of Projector Arrangement on Children Physical Activity

Loan Ngo and Fong-Gong Wu

Department of Industrial Design, National Cheng Kung University, Tainan, Taiwan (R.O.C.)
paid13@yahoo.com

Abstract. In kindergarten education, effective teaching is defined to be successful when children are learning while playing. As a combination of indoor and outdoor activities, the purpose of kindergarten education is to develop children physically, psychologically and socially. However, there are always some limitations from the surrounding environment that prevent kindergarten education from achieving its purposes. This study considers the effect of changing infrastructure inside the classroom on children's learning through physical activities, in particular, the effect of projector arrangement inside classrooms on kindergarten children's physical activities. This study is conducted in three different environments: "outdoor environment," "one-projector environment," and "two-projector environment" with the aim to learn about the effect of each environment on children's learning process through physical activities. The results point to a confident relationship between children's physical development and in class physical activities through interacting with projector images.

Keywords: Accessibility of Smart Environments, physical activities, children, projector.

1 Introduction

Kindergarten is the foundation for a child's life where he has most of his early childhood experiences. Therefore, kindergarten environment must be a safe place where children are protected from potential danger and are easily supervised. It is where the important physical activities of the day take place such as playing, eating, and sleeping. Beyond the basics, kindergarten is also important to help implementing and supporting the education program's philosophy and curriculum.

According to the World Health Organization (WHO), childhood obesity is one of the most serious public health challenges of the 21st century. Globally, in 2010, the number of overweight children under the age of five is estimated to be over 42 million. Close to 35 million of these are living in developing countries [1]. For children, a major contributing issue to obesity is that they are leading more sedentary lifestyles [2]. The rise in obesity has been attributed to sedentary behaviors, decreased in daily physical activities, and in daily physical education classes. Researchers have investigated the levels of physical activity, the amount of physical education and the level of fitness in relation to obesity. It is important to increase physical activities which also

at the same time reducing sedentary activities like watching television, playing video games or playing toys. However, for kindergarten, outdoor activities are not possible to conduct during gloomy weather, especially as mentioned, Southeast Asia region has extended rain seasons for almost half a year. During that period, teaching curriculum for kindergarten to have enough physical activities is even harder. In-class activities require more insight to organize because indoor environment is very limited.

2 Benefit of Physical Activity for Children

Kindergarten teaching focuses on helping children establish social relationships with each other through playing and doing group activities. Because the nature of learning at this age is through interacting with visual objects, the process of learning must be a combination of physical development and social relationship development. Scientific studies have demonstrated that physical activities improve on brain functions at every age level. It is also emphasized that physical activities enable the cells in the brain to be optimal, which maintain and improve brain functioning, and therefore give us the ability to learn and focus [3].

Developing control of muscles and movement is important for the infant's and child's ability to interact with her environment. Movement contributes to the organization of neural circuits that develop through the process of synaptogenesis, which permits children to learn to develop control over their sensory abilities and motor functions. Cognitive functioning is also facilitated by the process of myelination stimulated by movement. In addition, the cerebellum is affected by children's movement especially in the first few years of life as cells are forming functional circuits in the cerebellum which in turn affect spatial perception, memory, selective attention, language, handling of information, and decision making [4].

These findings are the positive effects of the structure and function of brains to improved memory and physical developments during time children learn and play with physical activities.

3 Physical and Mental Development during Early Childhood

3.1 Study Objective

“Early childhood” is generally defined in the developmental psychology as children age between two and six, namely, the sum of toddling children and preschool children. Children at this stage have been obviously changing in body and receiving great promotions in motor skills and cognitive abilities [5]. Meanwhile, those changes are closely related to biological factors as well as environmental factors which have some important impacts such as furniture, board and educational tools. That is the reason why we should choose the right education tools to combine with environment for kindergarten classrooms. The environment we choose will have decisive impacts on the way children feel about their studies. That will help organize the activities in

classrooms and give children a clear idea of where they need to be at specific times during the day.

In reality, most classrooms in kindergarten are not multi-functional, convenient or have enough space to help children completely develop. So how can we help children get more energy with physical activities during their times in class? In which way could existing persuasive principles in combination with context-aware systems be applied to motivate children to do exercise?

3.2 Element Necessary for Children Development in Kindergarten Classroom

Children’s learning is an active process. To accommodate this active learning process, figure 1 shows the elements necessary for classroom to help children develop. This conceptual model could be applied to understand the influences upon physical activities in children’s learning behavior.

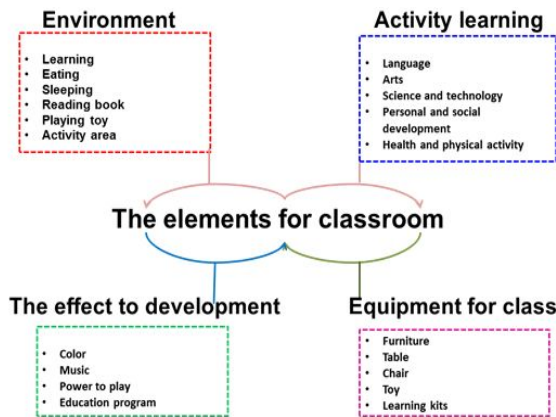


Fig. 1. The element necessary for children development in kindergarten classroom

4 Diagnosis of Children’s Behavior in Kindergarten Classroom through Observation and Interview

First kindergarten classroom, which had 3 to 4 year-old children and their teachers, were selected from the Red School House in Singapore to participate in the study. I chose this classroom for the study because the population of Singapore is really high comparing to the country area. There isn’t enough room for children to do activities. This kindergarten classroom was selected for the observation and interview.

The second kindergarten classroom, which had 5 to 6-year old children and their teachers, were selected from the Flower kindergarten in Vietnam. This classroom was chosen for the study because the weather in Vietnam only has two reasons – the rainy season and the dry season. There was limitation to organize children to do physical activities outdoors during rainy season. This kindergarten classroom was selected for

the observation, interview and the experiment on physical activities and projector arrangements.

There are no significant differences in the environment of kindergarten classrooms when I did the observation and interview. The data was achieved through the use of questionnaire for teachers and children's activity log in kindergarten.

The space and environment in classroom are the most important factors to help teachers organize activities. Some kind of physical activity and entertainment are organized outdoor such as exercise, sport, science and natural studying. Children like to play outdoors where they can have more activities, but it is hard for teachers to control all of them outdoors. When the class has outdoor activities, teachers need more help to control her children.

During extended rain and cold weather when outdoor activities are not possible, physical activity indoors should be increased by reducing sedentary time. Normally in this time, teachers want to organize physical activities that produce overall physical, psychological and social benefits for children. For example, 15 minutes of physical education outdoors is replaced by doing on-site exercises or on-site step dancing. During the on-site indoor activities, according to data measured, the average energy burned is 40% less than the average energy burned while doing outdoor physical education. Teachers also said that it was best for children's development during spring when the weather was not rainy and warm; children had good health, came to school more often without absent due to sickness.

During class time, it has been observed that children are really interested in computer related lessons. Those lessons are visualized and vivid enough to attract children's attention and speed up the learning process. Using projectors as teaching equipment has been adopted in kindergartens in Singapore and Vietnam. However, applying the relationship between physical activity and children learning process into kindergarten teaching curriculum is still a new concept. Only 15 minutes of exercise is not enough for a complete physical development, not to mention the environmental limitation when it comes to rainy seasons.

5 Experiment on the Relationship between Projector Arrangement and Children Physical Activity

5.1 Participants

Twelve children 3 to 6 year-olds (7 boys and 5 girls) (n=12) and their teachers were selected from the kindergarten classroom in Vietnam to participate in the experiment. They attended kindergarten at a child development center at Dalat City. This kindergarten is chosen for the study because the weather of Dalat city and the size of the classroom met the criteria described earlier in this paper. Among these children, two of them are 3 year olds and ten others are 5 to 6 year-olds (5 boys and 5 girls). They are in the same class and at the beginning of their experiences with the projector classroom.

All but one child's family indicated that they had computers at home; however, in most cases, parents reported to know just a little about software that helps develop physical activities for their kids. Parents also mentioned that no more than 30 minutes of computer access a day for their kids, and the main purpose of the home computer was mainly for adult use. So children don't really have physical activities or exercises at home.

5.2 Experiment Environments

In order to increase the level of physical activities for children, I did an experiment in the school environments on physical activities in kindergarten classrooms with three environments in a lesson on exercising. Twelve children ($n=12$, 7 boys, 5 girls) attended in three different environments: outdoor, indoor with 1 projector and indoor with 2 projectors.

Outdoor environment: children do exercise outdoors. It is 15 minutes morning physical education (PE) exercises with music. Under the instruction of teachers, children run around in circles and do traditional kindergarten exercises.



Fig. 2. Illustration of outdoor environment

One projector classroom: Children do on-site PE exercises in class following the images of projector on the classroom wall. The projector projects an animated video clip that has the instructions for PE exercises by cute characters with audio music. Also, there are markers on the classroom floor to help children recognize where to put their feet according to movements require long distance and large steps.

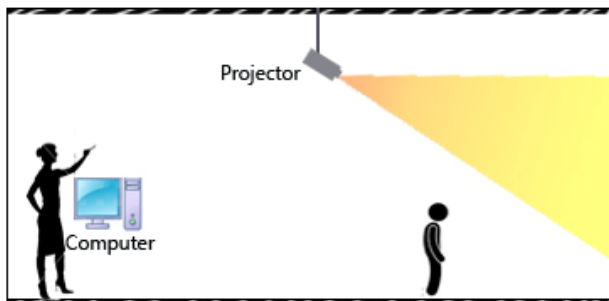


Fig. 3. Projector arrangement for one projector classroom



Fig. 4. Illustration of one projector classroom environment

Two-projector classroom: Children do on-site PE exercise in class with the support of two projectors. One projects on the classroom wall an animated video clip that has the instructions for PE exercises by cute characters with audio music. Another projector projects on the floor blinking steps that children need to follow along with the PE exercises.

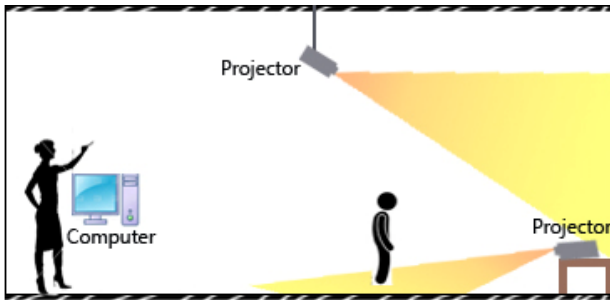


Fig. 5. Projectors arrangement for two projectors classroom



Fig. 6. Illustration of two projectors classroom environment

6 Result and Discussion

In this study, we focused on a novel kindergarten classroom-based environmental approach to the activity in children. We first compared physical activity levels, measured (using validated technology using Calorie Scanner Omron on children) energy dissipation, amount of fat burn and the movement steps during the PE exercises in the three experiment environments.

The dependent variable was the Calorie of energy dissipation (Kcal) between three environments. In the three environments (refer to table 1), outdoors showed the largest consumption of calories and under the one projector condition, children took the lowest consumption of calories.

Table 1. Dependent variable between environments

Independent Variables	Conditions	Calorie (Kcal)
Environments	Outdoor	19.50
	One projector	14.25
	Two projectors	19.25

Through repeated measures ANOVA, it was discovered that different environments had significant difference ($F_{2, 22} = 54.91$, $p < 0.001$). With least significance difference (LSD) applied to make a comparison, and there were two significant differences. It was revealed that the one-projector condition used up less calories than outdoors ($p = 0.000 < 0.001$) and the two-projector ($p = 0.000 < 0.001$) conditions.

According to my observation, in the first environment (outdoor), children do more physical activities than the second environment (one-projector classroom) because they have a bigger area to move, jump and run around. In the third environment (two-projector), children even have more physical activities than the second one. The second and third environments are both indoors, same classroom and same PE exercises. The only difference is the marker on the floor. In the second environment, there are simple and fixed markers while the markers in the third environment are dynamic and blinking. Children are more enjoyable in the third environment with two projectors than the second one. With the help of projector's image on the floors, children move faster and still can follow the rhythm of the exercise without looking at the one on the wall when they can't focus on both projector images at the same time.

According to the data collected, the calories of energy dissipation in the outdoors and the 2-projector environment are the same. The 1-projector environment dissipates less energy than the other two. Although the energy dissipation for the outdoors and the 2-projector environment is the same, the amount of fat burnt in the 2-projector environment is higher than the outdoor environment. This result is because during the PE periods, although the movement steps are less than in the outdoor environment due to limitation of available room to move, children move and jump with more intense movements and there are more forces acting on their bodies due to those intense movements. To recap, the two-projector environment has higher energy dissipation

and higher amount of fat burnt although it has less movement steps due to space available for indoor PE.

The advantage of outdoor PE is that the environment supports the best physical development for children. Indoor PE with two projectors has limitation on the available space but we can accommodate this. Although the two-projector environment is not the best, it's still good for physical development. It also supports children learning process because while watching instruction video, they can recognize simple alphabets or numbers showing in the video. Additionally, children can also develop their perceptions on the relation between audio instructions and visual images. This two-projector environment can be used to promote more physical activities combining with regular lessons. Doing that will decrease the probability for children to get sick when having outdoor activities during cold and rainy seasons, saving a lot of teacher's effort on monitoring children outdoors. This environment also promotes children's interest in learning with vivid and playful video and images.

7 Conclusion

Physical activity is not only needed for children's physical development but also help speed up the brain activity during the learning process. With the limitation of outdoor activities due to cold and rainy weather, physical education for kindergarten children should be conducted inside classrooms with the support of computerized equipment. Since kindergartens are already equipped with projectors as a tool of teaching, taking advantage of the use of projectors to promote physical activities indoor should be considered in the kindergarten teaching program. The purpose of this study is transforming physical activities into applications for indoor classrooms. In the future, this new teaching environment will help teachers in encouraging children to do more physical activities. Projectors will be used to change the classroom environment as a tool for teaching and also support physical activities. It is also an economic way to save on cost for actual tools for indoor physical activities.

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