Does Physics Perform Better in Preschools’ Education of Science

Haiou Zhang and Shijun Xu

ABSTRACT

Research on preschools’ science education had a long history. However, few studies have drawn upon appropriate activities to frame their research. This essay considers the question of how to select appropriate activities to help children understand science concepts, i.e., initial consideration of reasons and six assertions supporting the idea of physics. These are, in order: (1) Children naturally focus on physical property of objects. (2) Physical Experiments meet criteria for selecting appropriate activities. (3) It is the most popular in the actual teaching activities and various type of theoretical study on child science. Concrete illustrations of the ideas were discussed in this essay.1

INTRODUCTION

Children have cognitive needs which motivate them to recognize themselves and the world around them actively[1], especially science cognitive. Children’s formation of the laws of natural phenomena is based on their preconceptions about the characteristics of objects, substances, quantities and natural phenomena[2]. Appropriate simple experiments in play and games can help correct their gradual formation of science concepts[3].

Over the last 40 years, study of children’s scientific thinking and formation of scientific concepts has dominated science education research, of which researchers recognized how children understand scientific phenomena and concepts of the natural sciences. However, in recent years, research has increasingly focus on how

1Haiou Zhang, School of Education, Shaanxi Normal University, Xi’an 710062, China. Shijun Xu, School of Science, Xi’an Technological University, Xi’an 710021, China.
knowledge is culturally constructed, dynamically and socially produced, pushing against an individual deterministic perspective[4-6]. In spite of the fact that lots of studies have produced important results about the formation and nature of young children’s thinking about the natural sciences, more needs to be known about how to design suitable activity which meet children’s developmental psychology. According to children’s developmental psychology, Piaget’s theory and Copple’s criterion[7-8], physics is suitable for science education in preschool.

THREE REASONS FOR EXPOSING PHYSICS TO SCIENCE EDUCATION IN PRESCHOOL

We assert three reasons why physics is superior to other subject for preschoolers in science education. Before we describe each of these in detail, two points are needed to be declared. First, these three reasons are not completely independent for one another. For example, the second reason is clearly interrelated. According to the characteristics of preschool children’s developmental psychology, these reasons are the theoretical requirements for appropriate scientific activities. “Science is about the real world.” However, the way our justifications are formulated avoid to a great degree, the problems in the traditional justifications, as we shall see, and, certainly, gives the teacher solid reasons for science education relevant to young children in particular. The reasons are as follows.

Children Naturally Focus on Physical Property of Objects

Piaget contends that young children learn about objects not by observing and describing them but by acting on them materially and mentally, and observing the objects' reactions. Before abstract thinking, children prefer to act, observe and ask with objects and explore with their hands, mouths and eyes. During the establishment of scientific concepts, observation and experimentation play essential roles[9]. What children are getting? There are three levels at which carried out the process of knowledge, observational knowledge, empirical knowledge and theoretical knowledge[10-11]. For our pre-school children, they often acquire the external characteristics of objective objects through their various sensory organs. In consideration of safety, it is not allowed to taste even no smell. The size, color, shape, and softness are got at first which is also the basis for children to understand other properties of their objective objects by touching, observing and experiencing.

Physical Experiments Meet Criterion for Selecting Appropriate Activities

Piaget’s most ideas of transformation and contradiction have apparently been incorporated in the activity selection laid out by Copple, Sigel, and Saunders. They consider change an important criterion for selecting appropriate activities. The criteria they have proposed are the following: (a) the activity should provide
opportunities for the child’s own action, (b) the activity should involve discrepancies between what the child observes, (c) the activity should involve transformations and rapid changes (in the position and shape of objects, in the state, color of materials) that can be observed, and (d) the number of factors involved in the change should be limited[12].

Physical Experiments Will Provide More Opportunities for the Child’s Own Action

In comparison with other disciplines, variables in physics can be directly manipulated by young children, and the variable itself comes from the child itself. For example kinematics and mechanics are the most common physical phenomena. According to Newton's second law, the magnitude of force equals the product of mass and acceleration \( F = ma \). In young children's exploration activities, children can clear the meaning of force based on their own life experience, as well as the different size of the force for the same object effect differently. In a chemical reaction, the reaction is a combination of molecules between the different substances, rather than the actions of the children themselves. The operation of young children is only to provide the possibility for the chemical reaction of the substances, and the specific reaction process is the nature of the matter itself and the internal structure of matter. So does biology.

Physical Experiments Involve Transformations and Rapid Changes That Can Be Observed

In a physical relationship, direction or size of variable changes, immediately affecting the size or direction of the physical quantity associated with it. The change in physics is explicit, because it is not the reaction of chemistry to the microscopic particles of matte. It has a more simple causal relationship. When the direction of throwing things is changed, the object will immediately fall to different places. Children can easily acquire the specific meaning of physical quantities according to their own experience. Of course, there are also immediate changes in chemical reactions, but in chemical changes, the reaction is often involved in unsafe factors. Explicit and timely change is an incomparable advantage of physical change.

The Number of Factors Involved in the Change is Limited

In physical relationships, these can be the simplest with three variables. The most basic relation can be expressed with three variables. In physical experiments, complex physical relationships can be split, and ultimately the most basic expressions are sufficient. This provides a good opportunity to design more suitable scientific exploration activities. Different from physics, chemical science, even the most basic laws, there will be a lot of material reactions to performance. For example, reactions between acid and alkali produce salt. The composition of the
structure is complex, so the factors that affect its change are varied. What young children need is a simple causal relationship and a clear, explicit form of manifestation.

**The Physical Activity Involved Discrepancies between What the Child Observes**

At this point, physics is in possession of an absolute advantage. In the expression of various relationships, physics emphasizes quantity. The difference in quantity can lead to different results. 1 kilogram of the object, pushed forward with a Newton's force, the acceleration must be \( x (x<1) \text{m/s}^2 \). In the same environment, the final result of the motion will definitely change if the force is changed in size or direction. So do synthesis of colors. In a chemical reaction, hydrogen burns in oxygen, and eventually only produces water. This reaction will not be able to get other products because of different quantity of hydrogen or oxygen. Of course, some different reactions production results from different quantity. However, compared with the physics, discrepancy is not obvious or significant. Discrepancy what the child observes is significant in physical changes.

**IT IS THE MOST POPULAR**

First, in the practice of infant science education, the activity related to physics is favored by teachers. The game of Light and Shadow (the direct transmission of light), the ups and downs of different material objects in water (Archimedes principle) and so on are loved by young children, who can change the variables and observe the changes in their own operation. The design of these activities is also closely related to the life experience of young children. Slides, art classes, bath toys and so on, these specific life experiences are effectively combined with scientific exploration activities. Due to the implicit and the complexity of the participating components of the chemistry and biology, the whole belongs to the microcosmic level, which is not suitable for young children in the scientific exploration activities.

Physics is very popular not only in the teaching practice, but also in theoretical research. Piaget was the famous one studying of children's physical knowledge, and in his writings *Child's Conception of Movement and Speed* and *The child's conception of physical causality*, he studied force, movement and so on. Physical concepts are often used when children's scientific concepts are studied. Mechanical stability[13], gravity[14], and force[15] are the common physical quantities in the study of the formation process of young children's scientific concept. Even the study of children's cognition of natural phenomena, such as clouds and rainbows[16], is also at physical angle from the three states of water and the refraction of light, rather than the geographic angle. Haim, Eshach and Fried provide a selection of learning situations connected with specific scientific concept including heat and temperature, optics, Archimedes law of buoyancy and Newton third law[17]. The importance of
early childhood science is the focus of this article; however, the final resting point of science education is the concept of physics.

CONCLUSIONS

Through summarizing the practice activities and combining with the theoretical research, this paper combines the cognitive characteristics of young children with the characteristics of physics itself, thus explaining why physics is more suitable for children. In order to give kindergarten teachers more inspiration in the design of activities, promote the design and implementation of early childhood science activities.

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