

Science Teaching Environments in Early Childhood Education

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“Science in early childhood is of great importance for the development of children’s scientific concepts as well as for many other aspects of their development” (Kallery & Psillos, 2002, p. 50). Besides this, science is the part of life to understand the world better, so children start learning and practising the scientific concepts during the preschool age (Charlesworth & Lind, 2010). Therefore, having scientific knowledge of the world around us is important and it is formed since birth. Children’s first touches at homes are their initial experiences of science around them, for example; understanding of day and night, cooking, planting and so on. The activities are led by parents and playing prepares children to understand the world and increases the children’s readiness for formal learning. This is because daily activities in preschool education constitute the basis of science education (Önal & Sarıbaş, 2019).

Science activities are one of the required activities in early childhood education during daily activities. Daily routine activities in Turkey are identified by Preschool Education Programme, which are language (Turkish), art, drama, music, movement, play, science, math, preparation for literacy and field trips (Milli Eğitim Bakanlığı, 2013). Science is mentioned two different types: the science centre and science activities. While arranging classrooms with some centres (block, drama, art, book, science, sand and water, and music centres) in preschool, there are also some activities: language (Turkish), art, drama, music, movement, game, science, math, preparation for literacy, and field trips (Milli Eğitim Bakanlığı, 2013). These centres and activities are ideally recommended by Ministry of National Education as a preschool education programme in 2013, and teachers are required to follow this programme in their activities. As can be seen from the programme, science is given importance in both centres and activities. However, science activities are neglected as a result of lack of time (Charlesworth & Lind, 2010). In this case, Alisinanoğlu, Özbey and Kahveci (2007) underline that there is no requirement for expensive and various materials in early childhood education, children can get confronted with science via basic methods, inexpensive materials and enhanced learning environments. This means that science activities can be provided to children without any special requirements, and the existing facilities and opportunities can be used to conduct various science activities.

To conduct activities, teachers have the responsibilities to achieve such aims. However, the role of teachers is to ensure a wide range of opportunities for children to explore, experiment and discover in different learning environments such as indoors and

outdoors (Bose, Tsamaase, & Seetso, 2013). Within science activities, children's active participation to experiments, their observations to scientific aspects and attending the nature trips enable developing children's various skills like comparison, classification, identifying relationships, attention, observation, experimentation, hypothesising skills (Ayvaci, Devocioğlu, & Yiğit, 2002; Önal & Sarıbaş, 2019). Correspondingly, such skills can be enhanced by having experiments and exploring the environments as science activities (Akyol & Birinci Konur, 2018). In this case, various areas should be used to fulfil the requirements for science activities.

Therefore, it is important to provide a clear understanding of the context of schools to have an exact overview of the science teaching environments. In this case, the following aspects will be identified: classroom activities, outdoor activities, school grounds and field trips.

Science in Classrooms

One of the significant places for activities is the classroom, and teachers' primary preferences are classrooms for the activities. Indeed, the classroom is the first context when we think about school. This approach influences the case of science in the early years. Above-mentioned science centre and activities are subject to be practised in the classroom, and science is served in two ways: science centre and science activities. The example of an ideal classroom from the preschool education programme illustrates the necessary centres in a classroom, and number 5 shows the science centre. This is because the quality of the classroom and children's experience have a parallel relationship (Shim, Herwig, & Shelley, 2001). Furthermore, "the classroom environment needs to have comfortable and modifiable features according to the children's interests" (Dogan & Simsar, 2018, p. 72).

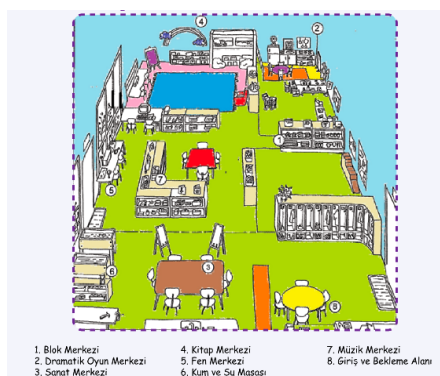


Image 1: Ideal Classroom Design

As it is an important part of a classroom, science centres are stimulant areas for children in terms of providing opportunities for experiments and observation (Önal & Sarıbaş, 2019). Additionally, science centres are required to be located in a place sun-soaked,

to be enriched with closets and shelves, and to have easy access to the garden (Simsar, Doğan, & Yalçın, 2017). Image 2 shows an example of a school in Turkey. Although there is a list of must-have characteristic for the science centre in schools, this example shows the inadequacy of required arrangements for the centre. This example illustrates the overall context of Turkey. While the preschool education programme emphasises the importance of science centres in schools which have enough spaces to create, schools have no/or insufficient science materials.



Image 2: A Classroom Example from Turkey

In this example, there is only a globe, artificial tree, scales, cones and experiment materials (three different colours in bottles and an agitation vessel). When the ideal classroom can be arranged in this space (as there is a wide scope), some materials such as natural materials and artificial science materials are put in a randomly selected place as a science centre in general.

Science should be promoted by both materials at the science centre and science activities through the daily routine activities in the early years. Science activity is the less preferred activity in daily activities. This is because, in the practice, there are always considerable differences between expected practices in classrooms and actual practices because of not having standardised opportunities in the classroom for science activities (Kallery & Psillos, 2002). For a science activity, teachers need to consider the activity in advance and to design in advance. Therefore, teachers might avoid conducting science activities

on a daily basis. In terms of having a determined procedure, in Akyol and Brinci Konur's (2018) research, teachers' practices show that they mostly conduct experiments during their daily activities because of having experiments as a part of ordinary activities. This is because experiments are arisen as key activities to achieve learning outcomes for science activities (Gezgin & Kılıç, 2015). Image 3 shows an activity that children build a rocket. From the teacher's reflection, it is a part of a list of combined activities that it is part of watching a documentary about rockets and space, then she let children constitute rockets from the materials in the classroom.

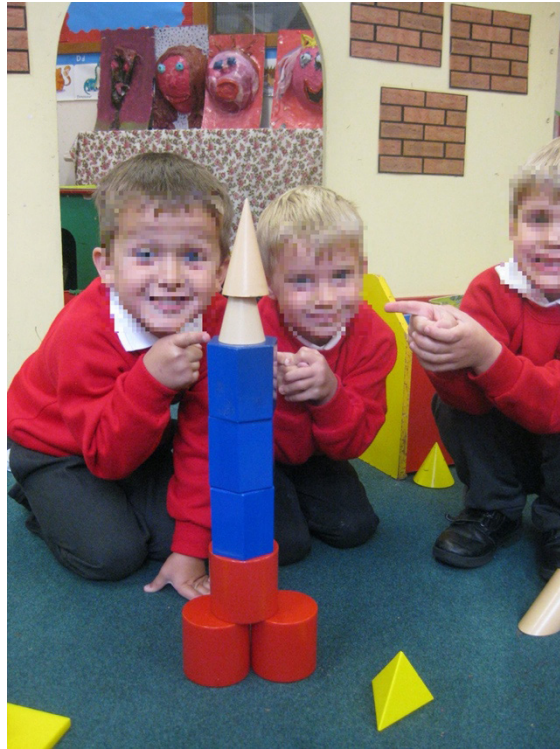


Image 3: A Science Example from England

Image 4 and 5 are from a kindergarten in Turkey. Both images are from science activities.



Image 4: A Science Example from Turkey (Making Cupcake)



Image 5: A Science Example from Turkey (Olive Making)

Image 4 is ‘making a cupcake’ and image 5 is ‘olive making’. In both examples, the teacher planned the activities before the activity days and prepared the required tools and materials in advance. For the example of image 4 illustrating, the teacher needs to check the ingredients for the cake and bought them considering the number of children with an arrangement of the classroom space. In the example of image 5, the teacher decided to have pickling as an activity. Therefore, s/he had to consider the season for this and the required vegetables. As it can be seen from image 5, the teacher prepared vegetables, vessels for cooperation etc., so children all can sit down to ground together as a big circle and can perform the necessary steps for pickling.

Parallel to given examples, mostly experiments and direct instructions were used, and teachers rarely considered implementing various methods as science activities (Dağlı & Dağlıoğlu, 2020). This is because teachers have feelings be competent for experiments, but they have unfavourable notion to develop materials for science (Dogan & Simsar, 2018). Teachers keen to use kitchen activities, experiments and watching documentaries as science activities, but the only small number of teachers uses the techniques: collection, identifying tools and using them and so on (Çınar, 2013). In this case, the classroom has objectives to be fulfilled in terms of science, but the practical part is different than the expected. Classrooms are the key areas to conduct science activities as it is the main place.

Science in Outdoors

Outdoor areas cover various aspects such as school grounds, parks, gardens and so on. As the classroom is mentioned as the key component for science activities as well as accommodating science centre, outdoor areas are likely to ensure the same opportunities. Thus, outdoors are considered by schools to have equal to or more important than indoor (Malone & Tranter, 2003). “The outdoor playground offered older preschoolers particular types of play experiences (i.e., functional play and dramatic play) more readily than the classroom” (Shim et al., 2001, p. 149). In preschool education programme, all types of activities, structured, semi-structured or unstructured activities, can be also conducted in outdoors like in the classroom (Milli Eğitim Bakanlığı, 2013). As there is no accurate requirement for outdoor activities, the statements in the programme emphasise it a few times as an additional area for children to have various activities. Alat et al. (2012), therefore, claims that some of the participating teachers in their research perform activities outside in addition to the classroom without needing a determination and requirement by the curriculum. In this case, Kermani and Aldemir underline that “... implementing a robust early childhood education curriculum focusing on math, science, and technology could bring a positive change in children’s overall learning of math, science, and technology as well as in teachers’ attitudes and ability to plan an integrated curriculum for young children” (2015, p. 1522).



Image 6: An English School's Outdoor Area

In terms of science, the science centre (and other learning centres) can be organised outside of the classroom as well, and science activities can be conducted in various ways to the contrary of the classroom. Image 6, from an English School, is an example of how outdoor area is connected to the school building as well as what how it could be. In image 6, the photo was taken in front of kindergarten's door to the outdoor area, and there is a path to a wide outdoor area. In this outdoor area, there are lots of materials and loose parts which can be used for science activities, and it is also close to nature, so various scientific process abilities: observation, classification, communication, measurement, prediction, deduction and comparison (Güneş, 2018; Murray, 2019; Önal & Sarıbaş, 2019) can be gained in well-designed outdoor areas. Çınar's (2013) finding of collecting flowers from school ground and examining their leaves, roots and bodies in the classroom can be smoothly accomplished in outdoor areas.



Image 7: An Outdoor Activity Area in Turkey

In previous research, teachers underlined the difficulties with practising science activities in classrooms, so teachers have dispositions to have such activities mostly outside (Bose et al., 2013). Sağlam and Aral's (2015) research indicates that science activities are perceived by children as interesting because of having used various, new and stimulus materials as well as natural and authentic. This is because science activities in outdoor provide scientific skills, "resilience, perseverance and confidence" (Murray, 2019, p. 219). Out of the classroom is furthermore mentioned with enjoyment and play via promoting child-led activities and learning (Maynard, Waters, & Clement, 2013).

However, there is likely to occur some problems with conducting outdoor activities. In this case, outdoor activities for science brings some drawbacks with it, and there are some bureaucratic challenges, insufficient materials and environments, economic issues and so on. (Türkmen, 2015). Image 7 shows an average school in Turkey. It can be seen that school ground is used for car parking, there is a few trees on the edge of the school ground and there is a small park with slide, teeter-totters etc. The ground of the park is soil and other places are surrounded by a concrete surface. It should be mentioned that the typical school grounds in Turkey is used for car parking, and children are needed to play among the cars. Önal and Sarıbaş (2019) found out that just over half of participating teachers claimed the inadequate school garden and outdoor areas for science activities.

Recently, the importance of outdoor areas has been increasing in various early years programmes to provide children to have regular access to natural grounds like "...the bush, the beach, local parks, creeks or botanical gardens, etc." (Christiansen, Hannan, Anderson, Coxon, & Fargher, 2018, p. 64). Other research shows that some activities are conducted outside in addition to indoor so that children's active participation can be employed; children can learn how to use science centre on their own as well as promoting a positive approach to science, and children's observation and interpretation skills can be developed in outdoors, but teachers had no endeavour to provide such outdoor opportunities (Ayvacı et al., 2002, p. 19). To support outdoor activities, teachers have various opportunities to conduct. These are; school grounds and field trips (which are commonly used in Turkey).

Science in School Grounds

One of the most used outdoor areas is school grounds, which are easily accessible for all early years teachers. Apart from the general concept of outdoor areas, school grounds consist of limited space within the area surrounding the building to identify the land of schools. As a basic activity which can be conducted school grounds, plant breeding can enable children to learn about types of soils and plant species (Önal & Sarıbaş, 2019). This is parallel to Sağlam and Aral's (2015) findings that children find a chance to check, to measure the growth of and to irrigate onions, which were planted in the school garden.

“Schoolgrounds have potential as a rich resource for formal learning” (Malone & Tranter, 2003, p. 94). Alat et al. (2012) claim that teachers are a key component to implement activities in school gardens because they can make arrangements as is required.

In the consideration of the requirement of hands-on learning, which is enhanced by observations, the importance of having well-designed school grounds are the best places to be considered to fulfil the aims (Karamustafaoğlu & Kandaz, 2006). For instance, image 8 shows a school ground from England. In this small space, it can be seen that there are water trays, wooden logs, a water tank and lines etc. These materials are designed to serve as a science centre and activity. As can be seen, the science centre can be constituted, and science activities can be performed although the space is limited.



Image 8: A School Ground from England

The most significant problem with using school grounds is that early years settings have no separated garden for themselves, and if they are part of primary schools, they, early years settings and primary schools, are obliged to share the same school gardens so that the use of school garden is limited (Alat et al., 2012; Mart, Alisinanoğlu, & Kesicioğlu, 2015). Parallel to these statements, image 9 demonstrates a typical example of the Turkish context. Overall schools have similar school grounds that the surface is covered with tarmac, so children need to play/do activities in this tarmac grounds.



Image 9: A School Ground in Turkey

In addition to this, there is no separate school ground for most of the kindergartens as being part of primary or secondary schools. While kindergarten is a younger age group only, various age groups can be on the playground at the same time (Shim et al., 2001). Even if the school is a nursery, “there often were two or three other classrooms of children on the playground at the same time” (Hirose, Koda, & Minami, 2012, p. 1614). In this shown activity, play and science activities are combined that while children are learning about capacity, they need to compete with others. The whole classroom separated two groups, and each group tries to fill the container with carrying water with cups. Though there is no specifically arranged school ground and materials for early years children, they are using common school ground for their activities. Correspondingly, previous research underlines the inadequacy of school grounds for preschool-age children (Karamustafaoğlu & Kandaz, 2006). Another example from the English context, image 10 indicates a similar inadequacy for the early years. In this example, school ground is used to arrange a science centre for children to play. Given that there is a small sand area with animal figures on it. Within this constraint, children still find chances to understand the animal kingdom.



Image 10: A School Ground in England

However, the fact is that although all schools have some extend school grounds, only half of them has school gardens, and most of these gardens was dominated by weeds, natural habitats and decoration plants. The participating teachers used school gardens for various activities such as science, movement, play and so on (Orçan Kaçan, Halmatov, & Kartaltepe, 2017). Image 11 shows a different example from the Turkish context. This kindergarten has a separated ground for them, and it is soil. The ground has been left unintended, so there are lumps and a few trees around the ground. In the seen activity, children are digging the ground to find worms and various insects. As it is hard to dig when it is dry, the teacher added some water to make it funnier. It can be seen that children are playing together and doing their activities. This area could also be used for plating. This is because one of the basic activities at school grounds is plant breeding and this activity enables children learning about soil/ground as well as contributing to learning plant species etc. (Önal & Sarıbaş, 2019). In addition to this, children can find chances to have a close relationship with living things so that can have sensory experiences (Çelik, 2012).



Image 11: A School Ground in Turkey

Sum up, school grounds can be limited but there could be provided lots of opportunities for children, there is no obligation to have a rich environment and materials. Any types of school grounds can be used to enhance the quality of science activities with planning.

Science in Field Trips

Field trips are mentioned as a type of activity in preschool education programme (Milli Eğitim Bakanlığı, 2013), but it is also an important learning adventure for science activities, and it is named under one of the science activities (Alisinanoğlu et al., 2007). Field trips support children's developments as well as provide real-life experiences so that children learn about social conceptions through field trips (Önal & Sarıbaş, 2019). "Children can learn about adult roles through field trips to businesses such as restaurants, banks, the post office, and stores both in the local neighbourhood and in the extended community. Museums, construction sites, hospitals, fire stations, and other places offer experiences that can enrich children's knowledge of adult roles" (Charlesworth & Lind, 2010, p. 307).

Field trips are connected with observation skills, so that observation is based on viewing human-beings, animals, plants and some events in their natural environment (Önal & Sarıbaş, 2019). Image 12 is from a visit to the museum of Atatürk's House. It can be seen that children are observing some objects displayed. This enables them to understand the history and cultural backgrounds as well as to recognise the meaning and effect of time in terms of scientific aspect. To achieve the aims of the field trips, teachers need to ask questions to provoke children's interest as well as providing observation opportunities via using their sensations (Alisinanoğlu et al., 2007).



Image 12: A School Visit to Museum

In previous research, field trips are considered as a high-quality method to teach science, but the participating teachers had a lack of knowledge on how to process field trips within their aims (Türkmen, 2015). Correspondingly, the reasons for avoiding to emphasise the importance of field trips are likely to occur because of the limitation of physical facilities or having a feeling of inadequacy (Akyol & Birinci Konur, 2018). In this case, teachers are required to be well-planned and prepared before the field trip. Image 13 shows a visit to the science centre, and a group of children is trying a simulation machine. Field trips are the best ways to provide first-hand experiences for children to learn about the context and provide a wide range of opportunities for teachers to promote learning that children can be asked to draw a type of material/object etc. (which will be seen at the science centre) before and after the trip, then they are asked to compare their both drawings so that teachers can raise a discussion on similarities and differences between the drawings (Charlesworth & Lind, 2010). Thus, children can compare their imagination and actual events/objects by themselves.



Image 13: A School Visit to Science Centre

Even though field trips provide a wide range of opportunities, there is likely to escalate some issues by stakeholders. It is claimed that having problems with transportation and handling with procedures make trips difficult for teachers and directors (Akyol & Birinci Konur, 2018). However, such problems and difficulties can be overcome for children not to miss the benefits of field trips to develop scientific abilities.

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