**Teaching about Astronomy and Space to Kindergarten Students:**

**Children's Attitudes and Projects**

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**Abstract**

Young children are familiar with some astronomical phenomena from everyday life, such as the movement of the heavenly bodies or the shift from day to night. These events are related to abstract astronomical concepts such as gravity or the essence of time. The present study examines the extent to which kindergarten students understand abstract concepts related to astronomical bodies and processes, and whether they change their perceptions of these concepts following an intervention program. The study also examines what children report about their learning experience following the intervention program.

The study combined quantitative and qualitative research methods. It was conducted in a kindergarten in Israel with 32 students. The kindergarten teacher used an intervention program that she developed under professional guidance. The children answered questionnaires regarding their knowledge of the subject before and after the intervention. In addition, observations and interviews with the children were conducted at the kindergarten. The children were asked to describe their learning experience, including how much they enjoyed it and why. The children did creative projects on the subject, for which they used materials such as paint, glue, and plasticine. The findings were quantitatively and qualitatively analyzed.

The findings show that only some of the children had knowledge about concepts related to astronomy prior to the learning process, and some expressed misconceptions about these concepts. Following the learning process, there was a significant increase in the children's knowledge and ability to explain astronomical concepts. This increase in their knowledge was reflected in their creative projects. It was also found that the misconceptions previously expressed by the children had been corrected, and they expressed scientifically correct knowledge of the concepts. Most of the children said they were interested in learning and saw it as a positive experience. This stemmed from their desire to explore, to have adventures, to be creative, and to admire the wonders of the universe. However, some children said they felt fear during the lessons.

The results of this study indicate that kindergarten students are able to study topics related to astronomy, although these concepts are abstract, and despite the difficulties involved in demonstrating them. The conclusion of the study is that teachers should be encouraged to integrate studies of astronomy and space into the science and technology curricula for kindergartens. This should be done using appropriate pedagogy that will increase the children’s interest and involvement in learning and avoid causing them fears.

**Literature Review**

**Teaching Science and Technology in Kindergartens**

 In educational systems around the world, developmental and social trends and processes are being formulated in order to fulfill the need to educate students so that they graduate with science and technological literacy. Studies show that science education can be adapted for young children, and that knowledge and understanding of scientific ideas can be achieved even at an early age. The prevailing view today in educational systems in Israel and around the world is that science education is an important field in the education of young children (Spektor-Levy, Kesner-Baruch & Mevarech, 2011). Researchers today no longer ask how early science and technology education should begin, but rather seek the most effective ways to teach it. Exposure of preschool children to science and math activities is seen as important, given their contribution to the development of logical reasoning and abstract thinking. However, in practice, it has been found that kindergarten teachers are concerned about the teaching of scientific subjects in general (Spektor-Levy, Kesner-Baruch & Mevarech, 2011) and topics related to astronomy and space in particular (Kallery, 2011) because these subjects are abstract and difficult to understand. These and other difficulties cause many elementary school and kindergarten teachers to avoid teaching topics related to astronomy and space (Chastenay, 2018).

 Many researchers believe that preschoolers are able to understand scientific concepts, including complex concepts, and have the ability to engage in scientific thinking (Eshach, 2006; Gelman & Brenneman, 2004). However, some early studies indicate that it is beyond the ability of young children to learn science, and that children aged 4-6 have difficulty understanding scientific ideas (Kampeza & Ravanis, 2006; Mali & Howe, 1979). Some researchers claim that before age 11-12, children cannot understand that experimental evidence may support or contradict scientific hypotheses and cannot differentiate between variables in a scientific experiment (Kuhn & Pearsall, 2000; Schauble, 1996). According to these studies, young children have difficulty in research-based learning, even when it is done using simple and authentic tasks. Young children find it difficult to formulate a research question, design an experiment to test it, predict the results of an experiment, evaluate its results, identify which variable determines the results, compare variables with each other, and link between cause and effect in a scientific experiment (Kuhn & Pearsall, 2000). It has been argued that young children have difficulty in analyzing the findings of an experiment because they are easily impressed by unusual results and do not pay enough attention to other, more common, results.