Preschool teachers attitudes towards the implementation of science and technology studies in Preschool

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Keywords: Preschool teachers attitudes, science and technology in Preschool.

Summary

This study examined the attitudes of preschool teachers towards the teaching of science and technology in Preschools in general and towards the program of science and technology by the Ministry of Education in particular. To examine the attitudes of Preschool teachers regarding the importance of teaching science to preschool children and its application, we used a עמדות questionnaire with statements graded according to the Likert scale to which 90 Preschool teachers answered. We interviewed eight (8) teachers referring to scientific content, to the teaching methods of science used by the Preschool teachers, and to the Preschool teachers' attitudes towards the application of the teaching program in the science and technology in their preschools.

The results of the study show that the Preschool teachers admit that they do not fully apply the teaching program in the Preschool, and although most of them are engaged in science activities in the Preschool, this is done mainly according to their personal knowledge rather that the professional program. All Preschool teachers have expressed positive attitudes towards teaching science in preschool, they see great importance in engaging in science in preschool and find it suitable for children. Teaching scientific content in preschool is done according to the preschool teachers even though they have to deal with time difficulties and no less with the lack of sufficient knowledge in teaching sciences. According to the teachers, they do not satisfactorily recognize the materials in the science and technology program and believe that professional development can contribute to better utilization of time and resources, to increasing cooperation with other educators and to promoting positive attitudes of preschool teachers towards teaching S&T in preschool. We therefore consider it important to promote continuing education for teaching sciences in general and in getting to know the program for S&T in particular, in order to improve the implementation of this program in preschools in Israel.

Introduction

The program for teaching science and technology (S&T) in preschools was published by the Israeli Ministry of Education in 2009 and in its final version in 2015. The program details the scientific contents and topics to be taught in preschool, and it outlines what skills, competencies, attitudes and values ​​towards science and the environment are to be developed in children. The program aims to instill in children ways of thinking and skills such as scientific research, technological design, solving of technological problems and the understanding of scientific concepts.

Preschool teachers encounter difficulties of various kinds during the teaching of S&T in preschool. These include lack of scientific knowledge, lack of self confidence in teaching scientific content, lack of time, and consequently, dissatisfaction and the lack of gratification

חוסר שביעות רצון וסיפוק עצמי (Spektor-Levy, Kesner-Baruch & Mevarech, 2011). The study presented here therefore sought to examine what are the attitudes of Preschool teachers towards the teaching of S&T in Preschool in general and towards the program of teaching S&T in particular, and whether there is a connection between these attitudes and the actual implementation of the program by the preschool teachers. The study also sought to examine the difficulties expressed by Preschool teachers regarding the implementation of science teaching according to this program in Preschools.

1. Literature review

1.1. Teaching S&T in preschool

The importance of science and technology education for young children is widely agreed by educators around the world (Spektor-Levy, Kesner-Baruch & Mevarech, 2011, [Furtado,](https://www.proquest.com/indexinglinkhandler/sng/au/Furtado,+Leena/$N?accountid=41238) 2010) and researchers today no longer wonder how early science education should begin (Gerde, Schachter, & Wasik, 2013) but rather seek for the most effective ways to teach it. Science and technology (S&T) education is considered appropriate for young children (Eshach, 2006; Gelman & Brenneman, 2004, Anderson & Gulberg, 2014) and regular science practices in preschool are considered crucial for children's learning in science ([Oppermann,](https://www.proquest.com/indexinglinkhandler/sng/au/Oppermann,+Elisa/$N?accountid=41238) [Hummel](https://www.proquest.com/indexinglinkhandler/sng/au/Hummel,+Theresia/$N?accountid=41238) and [Anders,](https://www.proquest.com/indexinglinkhandler/sng/au/Anders,+Yvonne/$N?accountid=41238) 2021) since the exposure of young children to scientific activities contribute to the development of intelligence and abstract thinking (Eshach & Fried, 2005). Young children are able to understand scientific complex concepts and have the ability to engage in scientific thinking (Eshach, 2006; Gelman & Brenneman, 2004) and they have cognitive abilities that allow them to understand scientific concepts and to acquire and apply the skills relevant to scientific research processes such as using research strategies, present research questions and hypotheses, make observations and experiments, predict the results and summarize the findings, and present the results and conclusions (Eshach, 2006; Eshach & Fried, 2005; Gerde, Schachter, & Wasik., 2013). Well designed teaching methods can promote young children to acquire basic scientific ideas pertaining to common phenomena in nature (Eberbach & Crowley, 2009; Kampeza & Ravanis, 2006) and the involvement of young children in science research in preschool develop their later skills of understanding of scientific ideas (Eshach & Fried, 2005, Roychoudhury, 2014, Plummer, 2014, Gerde et al., 2013), improve their readiness for school, and develop interest and positive attitudes towards science (Eberbach & Crowley, 2009). Teaching scientific processes at an early age affects students' attitudes towards science in the coming years (Hastürk & Özdemir, 2021). Evidently, encouraging young children to have positive attitudes towards and developing their interest in science and their motivation for achievement in this field improves the likelihood of their short-term and long-term interest in and success in the sciences (Eberbach & Crowley, 2009).

Researchers and educators search for the best ways to improve the teaching of S&T in preschool. In the United States, for example, there is an abundance of programs, information, and literature on teaching science in preschools, and yet Greenfield, Jirout, Greenberg, Maier & Fuccillo (2009) found that in the U.S. children enter school having little knowledge and undeveloped skills in science, and their readiness in science was smaller in comparison to other areas such as math, language and literacy and arts. Researchers believe that science is not taught effectively in preschools and that this may be why children lack the skills described in Greenfield et al. (2009).

One of the accepted assumptions in education and relevant to all age levels, is that everything children learn (knowledge, understanding, skills and attitudes) is greatly influenced by the way they are taught (Spektor-Levy et al., 2014, Andersson & Gullberg, 2011).The difficulties in teaching science in Preschool are due to the low efficiency of science educators, the lack of educational resources and the lack of programs that combine high-quality scientific experiences for young children (2014 & Gullberg, Andersson).

1.2 Program for the teaching of Science and Technology in Preschools in Israel

The program for teaching S&T to Preschool Children was developed by the Ministry of Education in 2009 and published in 2015-2016. The program defines the learning objectives, and details the contents and skills and the ways to achieve them, all while developing positive attitudes towards science and technology in children (Ministry of Education, 2013, p. 17). At the top of the program's goals is that of developing literacy in S&T, which includes developing thinking and knowledge of scientific concepts, and developing low and higher order thinking skills, that is developing thinking processes that enable the synthesis and reorganization of concepts. The program takes into consideration the developmental characteristics of the children, the characteristics of the Preschool teacher's work and the resources available to her. Naturally only a few topics can be included in the program chapters. The chosen topics of the program are familiar to children's everyday life and close to their world (Roychoudhury, 2013). These are ' weather and heavenly bodies', 'Man-made world' (products in our environment) and 'The human body'. The first and third topics emphasize science and the second topic focuses on technology.

1.3 Attitudes of Preschool teachers regarding the teaching of S&T in Preschool

The Preschool teacher is the primary educator in the Preschool, and it is important to examine all the factors that influence her teaching (Spektor-Levy et al., 2011). Positive attitudes of Preschool teachers towards the field of science in Preschool constitute a significant factor influencing the frequency of science teaching in Preschool classes and its quality (Greenfield et al., 2009; Spektor-Levy et al., 2011, Furtado, 2010, Saçkes, 2014). Children who studied with Preschool teachers with a positive approach to teaching science in Preschool and who applied quality practice in science, generally received higher scores in measures of curiosity, attitudes, knowledge and scientific abilities, compared to children who studied with Preschool teachers who were less likely to engage in quality science education (Spektor-Levy et al., 2011). In a study that examined the level of scientific knowledge of Preschool children during their participation in research activities, differences were found between Preschool children (35) who completed the research unit by quality mediation of Preschool teachers with positive attitudes towards science teaching and a control group (65) who did not receive such scientific teaching (Samarapungavan, Mantzicopoulos, & Patrick, 2008). The children in the intervention group were more successful than the control group in all measures of scientific learning: they asked questions of biological significance, recorded observations, used empirical evidence to expand and develop their knowledge. In addition, these children were able to discuss with their peers the results of their investigation, showed a good understanding of key aspects of scientific learning such as hypothesis, observation, keeping records and using tools (magnifying glass and notebook). The children from the intervention group also discovered scientific knowledge in the subject of their study (Samarapungavan et al., 2008).

The attitudes of pre-school teachers towards science education is of great importance to their הוראה בפועל ([Hastürk](https://www.proquest.com/indexinglinkhandler/sng/au/Hast$fcrk,+Gamze/$N?accountid=41238)  and [Özdemir,](https://www.proquest.com/indexinglinkhandler/sng/au/$d6zdemir,+Oguzhan/$N?accountid=41238) 2021). The position of the vast majority of Preschool teachers is that already in early childhood one should start engaging in scientific subjects and young children are able to engage in research activities so indeed, most Preschool teachers report that each week they engage in math and science in Preschool (Spektor-Levy et al., 2011). Most learning focuses on topics relevant to children's daily lives such as the garden and plants, animals, the seasons and the weather. Some Preschool teachers use measurement tools and scientific measurement methods, and some also engage in environmental education. Studies have found a significant positive relationship between the teacher's attitude to learning science and her love of engaging in these subjects, and the extent to which she incorporates science topics in Preschool: the more importance the teacher attaches to scientific activity in Preschool, the more she implemented such activity (Spektor-Levy et al., 2011). It was also found that effective vocational training and professional development of Preschool teachers were related to the development of positive attitudes towards teaching science in Preschool (Pendergast, Lieberman-betz, & Vail, 2017; Maier, Greenfield, & Bulotsky-Shearer, 2013,) and subsequently to a greater and more effective engagement of scientific topics in the class. However, even though in recent years Preschoolers seem to be more comfortable incorporating scientific activities into their Preschool work, and they better understand the benefits of teaching science to young children than in the past, Preschool teachers still continue to point to feelings of inadequacy and even anxiety about their own scientific knowledge and their ability to promote scientific learning of Preschool children (Pendergast, Lieberman-betz, & Vail, 2017).

According to Hastürk and Özdemir (2021), preschool teachers' positive attitudes towards science education will lead to more effective classroom practices and science teaching. The importance of having positive attitudes towards science among preschool teachers led researchers to examine the association of parameters such as self efficacy beliefs and perceptions of the preschool teachers to their educational practice of science in class (Hastürk & Özdemir, 2021; Furtado, 2010; Saçkes, 2014;

Oppermann, Hummel & Anders, 2021; Yagmur-Kolcu, & Öztuna-Kaplan, 2020). Professional development, the availability of science related instructional materials in the classrooms, but above all the teachers' perceptions of children's capacity for learning and the self belief of teachers in their ability to teach sciences do influence the frequency of teaching science subjects by those teachers (Saçkes, 2014), yet most of them feel inadequate and are not interested in the field of science (Yagmur-Kolcu & Öztuna-Kaplan, 2020). The consequences are poor science teaching with poor students' scientific knowledge. It was as well found (Yagmur-Kolcu &Öztuna-Kaplan, 2020) that preschool teachers often include science activities into their programs but they cannot be creative in these activities, they neither know nor question why they do such activities and do not diversify the activities. In addition, it was observed that preschool teachers had a lack of knowledge in the field of science and this led to the development of scientific misconceptions for the students.

Hence the question arises as to the level of application of the S&T program in Preschools in the country: Is it carried out as required and requested? In this study we sought to examine the attitudes of Preschool teachers regarding science teaching in general and the implementation of the program for R&D in particular. We were asking to study what teachers suggest as ways to help promote positive attitudes to science teaching, and to increase the actual implementation of science teaching programs in Preschool.

The objectives of the study were:

A. To examine the attitudes of Preschool teachers towards teaching S&T in Preschools

B. To examine what the Preschool teachers report on the application of the program in the Preschool, as carried out by them.

The research questions were:

A. What are the attitudes of Preschool teachers towards teaching S & T in Preschool in terms of the importance of the program, the feeling of comfort to apply it, and the actual application?

B. What do the Preschool teachers report on the extent to which they are familiar with the S & T program and how it is implemented by them?

C. What are the difficulties in applying the S&T program as expressed by the Preschool teachers?

2. methodology

2.1. The study population

The study involved 90 Preschool teachers in Preschools for ages 3-6. Most of he teachers work at the southern region of the country, most of them (85.7%) from the secular state education and the rest from the state-religious education. About two-thirds (63%) of the Preschool teachers had a teaching certificate and a bachelor's degree and the others Masters degree. About 74% work at peripheral regions, and about a quarter (26%) in urban Preschools.

Of the Preschool teachers who participated in the first part of the study, eight (8) agreed to be interviewed and were thus selected for the second part. Their ותק years of experience ranged from 5 to over 20 years.

2.2. The research method and tools and the research procedure

The study combined a quantitative and qualitative methodology. The attitudes of the teachers were examined in two stages. In the first phase, Preschool teachers answered an online personal questionnaire (table. 1) with 31 statements on a Likert base scale on their implementing scientific activities. The questionnaire that was developed by Maier et al., (2013), was translated by us and adapted for Preschool teachers in Israel. The internal reliability of the questionnaire was very good (Cronbach’s alpha **= 0.91**). The Preschool teachers in our study were asked to indicate the degree of their agreement with each of the **31** statements dealing with attitudes toward teaching science and technology in Preschools according to a 4-degree Likert scale: 1- strongly disagree, 2- slightly agree, 3- strongly agree, 4- strongly agree.

In the second phase of the study we conducted a semi-structured personal interview with eight (8) of the Preschool teachers who answered the questionnaire. The interview, developed by Israeli researchers (Spektor-Levy et al., 2011), examined the Preschool teachers' attitudes regarding the application of S&T program by them. The interview lasted about 30-45 minutes and dealt with scientific content, teaching methods and methods of action of the Preschool teacher in teaching science in Preschool. We added to the original questionnaire questions regarding the frequency of scientific activity in the Preschool, the learning environment, the scientific equipment, familiarity with the scientific materials in the Preschool, the attitudes towards its implementation, the implementation of the program goals and difficulties arising while teaching science. The questionnaire appears in table 1.

Table 1.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Mean | Std. Deviation |
| 1 | פעילויות מדעיות בגיל הרך עוזרות לעורר עניין למדע אצל ילדים בגיל מאוחר יותר | 3.69 | .512 |
| 2 | אני מרגישה בנוח לתכנן ולהדגים בכיתה פעילויות הקשורות בתחום מדעי הפיזיקה והאנרגיה. לדוגמא, כוח המשיכה ומצבי צבירה (מוצק, נוזל וגז) | 3.09 | .944 |
| 3 | יש להתחיל את העיסוק בנושאים מדעיים כבר בגיל הרך | 3.80 | .429 |
| 4 | הזמן המוקדש ללימוד מדעים אינו מספיק, בשל התחשבות בדרישות נוספות. | 2.84 | .947 |
| 5 | התנסות מעשית עם חומרים וחפצים היא הדרך בה ילדים לומדים בצורה הטובה ביותר. | 3.91 | .286 |
| 6 | פעילויות הקשורות למדע משפרות גישות ללמידה בגיל הרך | 3.51 | .640 |
| 7 | אני דנה ברעיונות ונושאים הקשורים בלימוד מדעים עם מורים אחרים. | 2.43 | .960 |
| 8 | אני משתמשת בכל סוגי החומרים לצורך פעילויות מדעיות, למשל צעצועים, קופסאות | 3.20 | .864 |
| 9 | הכנה לקראת הוראת מדעים לוקחת זמן רב יותר מאשר הכנה לתחומים אחרים | 2.57 | .912 |
| 10 | אני משתמשת בספרים על מנת לקבל רעיונות לפעילויות מדעיות בגיל הרך | 2.92 | .951 |
| 11 | אני מרגישה בנוח בביצוע פעילויות מדעיות בגני | 3.29 | .811 |
| 12 | אני מרגישה בנוח לתכנן ולהדגים בכיתה פעילויות הקשורות בתחום הביולוגיה (למשל, יצורים חיים, צמחים, בעלי חיים) | 3.07 | .946 |
| 13 | פעילויות הקשורות למדע בגיל הרך משפרות כישורים מתמטיים אצל הילדים | 3.23 | .875 |
| 14 | פעילויות הקשורות למדע בגיל הרך משפרות כישורים שפתיים אצל הילדים. | 3.48 | .674 |
| 15 | אין לי מספיק ידע מדעי על מנת ללמד ילדים צעירים מדע | 2.89 | .953 |
| 16 | אני מרגישה שלא בנוח לדבר עם הילדים על שיטות מדעיות ( למשל, להעלות השערות, לנבא תוצאות של ניסוי, לערוך ניסוי) | 3.58 | .793 |
| 17 | אני משתמשת באינטרנט לצורך קבלת רעיונות לפעילויות מדעיות לילדים צעירים. | 3.47 | .810 |
| 18 | ילדים צעירים לא יכולים ללמוד מדעים עד שילמדו לקרוא | 1.07 | .361 |
| 19 | אני מקבלת רעיונות לפעילות מעשית מפעילויות הילדים, מאמירותיהם ומשאלותיהם | 3.21 | .786 |
| 20 | פעילות הקשורה למדעים קשה מידי לילדים בגן | 3.67 | .636 |
| 21 | אני משלבת פרקים מספרים מדעים בשעת סיפור בגן | 2.07 | .922 |
| 22 | פעילויות הקשורות למדע בגיל הרך משפרות כישורים חברתיים אצל הילדים | 2.97 | .841 |
| 23 | אני נהנית מעיסוק במדע עם ילדי הגן | 3.32 | .805 |
| 24 | אני פוחדת שהילדים עלולים לשאול שאלה על תופעות או עקרונות מדעיים שלא אוכל לענות. | 3.28 | .948 |
| 25 | אני מדגימה תהליכים (למשל, השוואת חפצים כדי לראות האם הם יצופו או ישקעו במים) | 3.61 | .575 |
| 26 | תכנון וייצוג התנסות מדעית הם משימה קשה | 3.02 | .874 |
| 27 | ילדים צעירים הם סקרנים לתפיסות מדעיות ותופעות. | 3.73 | .536 |
| 28 | אין לי מספיק חומר לעיסוק במדע | 3.01 | 1.011 |
| 29 | אני מתאמצת לשלב פעילויות מדעיות בכל יום | 2.31 | 1.013 |
| 30 | אני מרגישה בנוח לתכנן ולהציג בכיתה פעילויות הקשורות למדעי כדור הארץ (למשל, שמש, ירח, כוכבים ומזג האוויר) | 2.97 | .965 |
| 31 | אני אוספת חומרים וחפצים לשימוש בהוראת מדעים | 3.03 | .880 |
|  | פעילויות מדעיות בגיל הרך עוזרות לעורר עניין למדע אצל ילדים בגיל מאוחר יותר |  |  |

2.3

Processing of the findings

The **31** statements were grouped into 4 main categories that were found to be reliable after factor analysis using the varimax method with orthogonal rotation as shown in table 2: seven (7) statements refer to the Preschool teacher's attitudes regarding the importance of teaching science to Preschool children. Fourteen (14) statements in the questionnaire refer to the teacher's feeling of comfort in teaching science. Nine (9) statements refer to the actual application of scientific activity in Preschool by the Preschool teacher. Seven (7) statements refer to the Preschool teacher's position regarding difficulties in dealing with challenges in teaching science in Preschool. This order differs from the 3-category arrangement of the original questionnaire (Maier et al., 2013) by adding a category of Preschool teachers' attitudes regarding the actual application of scientific activity by the Preschool teacher. Four (4) statements were omitted from the original questionnaire due to low Kronbach's alpha values. Kronbach's alpha values ​​for each category are shown in table **1.**

. In the process of quantitative analysis, a match was examined between the Preschool teachers' attitude toward science teaching and their attitudes regarding the actual application of science teaching according to their report. A t-test was performed to compare averages in two independent samples in order to examine whether there was an effect of the Preschool teacher's background data (her education, the nature of the position in the Preschool, her age, the nature of the locality where she serves as a Preschooler) on her attitudes toward the place and importance of teaching math in Preschool, and what is this effect.

In addition, the Pearson test examined the relationship between the four categories of the questionnaire.

The data obtained from the semi-structured personal interviews were processed through content analysis. For the analysis of the interviews, we used a categorical analysis that was performed by a sorting process in which data pieces belonging to the same phenomenon were added together and created content units that are statements from the analyzed content. The product of the analysis is thematic categories. In the first stage, a preliminary analysis was conducted by selecting statements from the Preschool teachers' answers, which relate to the research questions. Subsequently, the data were divided into criteria and the initial categories that were reduced to the core categories were identified. In the final step we conducted the mapping analysis by finding links between the categories and creating a new set of categories. After the mapping analysis, a new order of categories is created as follows:

1. Preschool teachers' attitudes towards the importance of the application of the education program of S&T in Preschools, b. The feeling of comfort of Preschool teachers to teach science in Preschool, c. The Preschool teachers' description of the manner in which program is applied in Preschools by them, and d. The difficulties in applying the program as described by the Preschool teachers.

**3. Results**

3.1. Preschool teachers' attitudes towards teaching science in Preschool

A summary of the Preschool teachers' attitudes towards engaging in science in the Preschool appears in **Table No 2.**

טבלה 2: המהימנות והתפלגות המשתנים הרציפים באוכלוסיית המדגם, N=90.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **משתנה** | **מספר ההיגדים** | **M** | **SD** | **α קרונבך** |
| ממוצע כללי בשאלון | 31 | 3.07 | 0.35 | 0.88 |
| חשיבות הוראת המדעים בגן | 7 | 3.49 | 0.41 | 0.74 |
| הרגשת נוחות ללמד מדעים בגן | 7 | 3.14 | 0.60 | 0.82 |
| יישום הפעילות המדעית בגן | 8 | 2.99 | 0.53 | 0.77 |
| קשיי הגננית בהוראת מדעים בגן | 9 | 2.77 | 0.24 | 0.46 |

The category 'Importance of teaching science in Preschool' received a high score of 3.49 (Table No. 2, row 2). This result reflects that the Preschool teachers find science teaching to be important and appropriate in young children, and that it can improve their mathematical and verbal skills. All the Preschool teachers agreed that they should start dealing with scientific topics from an early age, and in their opinion, studying science in Preschool is extremely important and contributes to the child's long-term development as well. The category 'Feeling comfortable for the teacher to teach science' (Table No. 2, line 3) was tested on the assumption that the teacher's feeling of comfort in teaching science has an impact on the application of science teaching in Preschool by her, i.e. the more the teacher feels comfortable teaching science she will indeed implement more activities in this direction and the children will be interested and develop curiosity in the science profession. In this category, the average score was 3.14, showing that most Preschool teachers feel comfortable teaching science in Preschool. Most Preschool teachers (over 80%) reported that they enjoy engaging in science and feel comfortable conducting various scientific activities in the Preschool. Over 70% of Preschool teachers feel comfortable to plan and demonstrate activities and processes related to the fields of physics and biology. At the same time, using of science books in teaching and the sharing of the practices of science with other teachers showed an average score closer to 2.00, meaning that the teachers less utilize these areas.

In the group of statements regarding the attitudes of Preschool teachers in the category 'Implementation of scientific activity in Preschool by the Preschool teacher', an average score of **2.99** was obtained (Table No. 2, line 4). This shows that according to them, most Preschool teachers are in fact engaged in scientific activities in the Preschool. Most (79%) receive ideas for practical activities from the children's activities, collect materials online and most of them (97%) demonstrate physical processes to children. At the same time, the scientific activity in the Preschool is limited, for example a considerable part of the Preschool teachers (58%) do not make an effort to combine scientific activities every day and do not combine (80%) chapters from scientific numbers during a story telling time in the class.

The category 'Preschool difficulty in dealing with challenges' (Table No. 2, line 5) shows a relatively low overall average **- 2.77**. Apparently, this score indicates that Preschoolers do not think there is difficulty in teaching science in Preschool. But on closer inspection of each statement individually one finds great heterogeneity in attitudes towards ‘Preschooler difficulty in dealing with challenges’, and the alpha Cronbach of this category is low. While some Preschoolers claim to be able to overcome them, others find it difficult to cope with the difficulties and challenges of teaching science in Preschool. For example, a significant proportion of Preschool teachers (61.5%) strongly agree or largely agree that the time devoted to studying science is insufficient, due to consideration of other teaching requirements. In fact, the main problem that comes up again and again in the words of Preschool teachers is the lack of time resource: most Preschool teachers think that they do not devote proper and sufficient time to teaching science in Preschool. About 44.2% of Preschool teachers claim that preparing for science teaching takes longer than for other fields. Even if about two-thirds (67.4%) estimate that they have sufficient scientific knowledge, the remaining third (32.6%) of Preschool teachers believe that their scientific knowledge is not sufficient to teach science in Preschool.

Moreover, although more than half of the Preschool teachers who participated in the study said that they were not afraid of the children's questions, about a quarter of them (28%) were certainly afraid that they would not be able to answer the children's questions about phenomena or scientific principles.

In the comparison test using a t test between the background variables of the Preschool teachers, which are the Preschool teacher's seniority, age, education, age of the Preschool children or the type of locality in which the Preschool is located, and the Preschool teachers' attitudes, we found no significant differences.

In the Pearson test (Table 3) that examined correlation between categories, significant correlations were found

נמצאו מתאמים חיוביים מובהקים בעוצמה נמוכה עד גבוהה בין כל אחד מהגורמים בשאלון.

between each of the categories and all the other categories:

A positive correlation was found between the importance that the teacher sees in learning science in Preschool and feeling comfortable to teach sciences (0.470) and even more the implementation of scientific activity by the teacher (0.608). The more importance the teacher sees in learning science, the more she is comfortable to do so and the more she reports that she applies this learning. Positive correlations were found between the teacher's feeling of comfort in teaching science in Preschool and the implementation of scientific activity by the Preschool teacher (0.730). This correlation between the teacher's feeling comfortable teaching science and the application of actual science teaching is relatively high.

A negative correlation was found between the teacher's comfort in teaching science in Preschool and the teacher's difficulty in dealing with teaching science in Preschool (greater difficulty is accompanied by a lower feeling of comfort in teaching science), and negative correlations were found in the teacher's difficulty in dealing with science teaching challenges. Preschool teacher and the importance that the teacher gives to teaching science in Preschool. The application of scientific activity and the importance that the teacher sees in this decreased were lowered with the increase in the teacher's difficulty in dealing with the challenges of teaching science in the Preschool.

טבלה 3: מתאמי פירסון המחושבים בין ארבעת משתני המחקר (חרדה, תחושת מסוגלות, אופטימיות ותמיכה חברתית.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | חשיבות הוראת המדעים בגן | הרגשת נוחות ללמד מדעים בגן | יישום הפעילות המדעית בגן | קשיי הגננית בהוראת מדעים בגן |
| חשיבות הוראת המדעים בגן | 1 | .470\*\* | .608\*\* | .237\* |
| הרגשת נוחות ללמד מדעים בגן |  | 1 | .730\*\* | .366\*\* |
| יישום הפעילות המדעית בגן |  |  | 1 | .273\*\* |
| קשיי הגננית בהוראת מדעים בגן |  |  |  | 1 |

\* p < 0.05, \*\* p < 0.01 (two-tailed)

**טבלה מס. 2. מתאמים בין הקטגוריות של עמדות הגננות (42= (N. רמת המובהקות הינה 0.01.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **חשיבות הוראת מדעים בגן** | **הרגשת הנוחות ללמד מדעים בגן** | **יישום הפעילות המדעית בגן** | **קשיי הגננת בהוראת מדעים בגן** |
| **חשיבות הוראת מדעים בגן** | 1 | 0.542 | 0.579 | 0.412- |
| **הרגשת הנוחות ללמד מדעים בגן** | 0.542 | 1 | 0.954 | 0.570- |
| **יישום הפעילות המדעית בגן** | 0.579 | 0.954 | 1 | 0.485- |
| **קשיי הגננת בהוראת מדעים בגן** | 0.412- | 0.570- | 0.485- | 1 |

לשם בחינת ההשערה לפיה ימצא הבדל בגורמים השונים של השאלון בין הקבוצה הראשונה של הגננות לקבוצה השנייה בוצעו מבחני t למדגמים בלתי תלויים על כל אחד מהגורמים המרכיבים את השאלון. לא נמצאו הבדלים מובהקים בין ממוצעי שתי הקבוצות באף אחד מגורמי השאלון: חשיבות הוראת מדעים בגן (t(88) = .12, p = .900); הרגשת נוחות ללמד מדעים בגן (t(88) = .007, p = .995); יישום פעילות מדעית בגן (t(88) = .48, p = .633); וקשיי הגננית בהוראת מדעים בגן (t(88) = .55, p = .580). תוצאות המבחנים מפורטות בלוח ##.

לוח ##: ממוצעים וסטיות תקן של ארבעת גורמי השאלון בחלוקה לקבוצות המחקר. מוצגים ערכים קריטיים t ודרגות חופש לכל השוואה.

קבוצה 1 (n=42) קבוצה 2 (n=48) t test (independent)

M SD M SD df t

חשיבות הוראת מדעים 3.49 0.39 3.48 0.43 88 .12

הרגשת נוחות 3.14 0.62 3.14 0.58 88 .01

יישום 2.96 0.56 3.02 0.51 88 .48

קשיי הגננית 2.75 0.22 2.78 0.27 88 .58

\* p < 0.05, \*\* p < 0.01 (two-tailed)The teachers' acquaintance with the TOHL in the S&T and its goals

In the second part of the study, we asked to learn about the attitudes of Preschool teachers regarding the program of S&T and to hear about their experiences as they express themselves in their own words, through interviews conducted with eight (8) Preschool teachers. The questionnaire we used in the first part did not address specifically, while the personal interviews (Appendix No. 1) dealt (the first 5 questions) with the teaching of S&T in Preschool in general, and then with the program itself and its implementation by the Preschool teacher (the last 5 questions). When we examined how deeply the teachers are acquainted with the program, we found that almost all of the Preschool teachers said that they knew about the program, but only a minority knew it to a large extent and used it to plan their teaching in the curriculum.

Their main use of the S&T program document includes the selection of the learning contents and the designated skills. Most Preschoolers reported on low familiarity with the program saying: "I read the program, but it was a long time ago," "I know less about the program itself" (3) ,, " I know in general "(4)," know so so.. "(5)," yes, more or less "(7), and "I do not really know the plan. I have not seen it yet"(8). In actual teaching, Preschool teachers use the program little or not at all. In their opinion, working with the document does not help while teaching because "the plan is not clear and not detailed enough" (5) and it was even explicitly stated: "If I knew the plan better, then I would probably use it more" (5).

The Preschool teachers also claimed that they did not know the goals of the program, and some (three out of eight) did not know the goals at all. Some teachers claimed to know some of the goals and even implement them. For example, a teacher said: "But some I do not apply. Not enough. For example, I do not relate at all and do not know what should be taught according to the astronomy curriculum?" (4). Similar to the findings from the first part of the study, we found in interviews that most Preschool teachers saw great importance in the application of the program in Preschools. They argued that the program should definitely be implemented, defining it as "an important program, a good program that can help the teacher in her work" (4), "It should be implemented at both young and adult ages. The program addresses important things like scientific language, phenomena ... " (6), "It's good to have a program. The program gives ideas and can help. Obviously it needs to be implemented" (3). This is in line with the results from the first part of the study, in which it was found that all Preschool teachers expressed a positive attitude in favor of teaching science in Preschool. Even if a minority of Preschool teachers expressed some doubt about the program, they still considered it important and added that "the program is good. The plan should be implemented intelligently and regularily "(1), "The program should be well known and implemented"(7 or " It probably should be applied"(5).

At the same time, an analysis of the interviews shows that all the Preschool teachers were in fact engaged in teaching scientific content in the Preschool, even if not according to the program. Four Preschool teachers reported that they deal with scientific content on all three topics listed in the program, while four other Preschool teachers reported that they deal with only two of the three topics.

3.3. Frequency of scientific activity in Preschool

About half (four, 4) of the Preschool teachers reported that they engage every day in some way a scientific activity in the Preschool. They said with great enthusiasm that they were engaged in science "every and each day " (3). The scientific activity is also done everywhere: in class, in the yard, on a trip, and at home as well. The Preschool teachers proudly said that the children "bring from home things that are engaged to the teaching" (7), that the parents share with them the children's interest in science and continued learning at home. The Preschool teachers stated that they also combine mathematics, literacy and sustainability education in the teaching of science. Some Preschool teachers had difficulty defining the frequency of scientific activity in the Preschool. Two Preschool teachers who said they implement scientific activity twice a week and two others who talked about twice a month, and even said they think they do not spend enough time teaching science: "It's not enough, not to the extent I would like" (5), "Not the frequency I would like it to be"(8) and "no time. I have birthdays and other parties, no time for everything" (4).

3.4 Ways of teaching science in Preschool

All of the interviewed Preschool teachers said that they use different ways of teaching science, such as "learning by doing", "learning around problems" and "learning by research". For example: "Extraction of olives. It was a very interesting experience. I brought them olives. They crushed them, felt the oil ..." (7). Or: "Snails: That's something that terribly bothers them. We gave them food, at the end of the day we washed the box. The children were involved in the whole process. We checked what they ate and what they did not eat ..."(5). "Sometimes we do the experiments in groups as well. This is how we did the evaporation experiment using the kettle." (1). Most Preschool teachers use verbal learning a lot, even though they agree that this teaching is sometime less appropriate for Preschool children. They do this due to lack of time and the ability to teach individually. A teacher describes: "There are a lot of activities I have to do during the day. I do not have enough time to do so much in groups" (2). Another teacher expressed concern and frustration that she did not always use teaching methods that she thought were appropriate for scientific activity: “I have an hour and something a day that I can do (teach science). I try to work in small groups ... If I teach the whole class ... activity in the sciences loses .. all its value... especially where there are two age groups. The youngers are ... not sitting. On the other hand, the older, it is clear that they will understand. Do the scientific activity only with them. In the end everything dissipates מתמסמס and it's a pity ... every time I try, but that's the way it is "(6). "In the sciences I do not know how to build it gradually. Where do I start? how to continue? I do use tools but what is better to start with? What is the order? Maybe it is not worth it at all"(8).

3.5. Teachers difficulties in the process of implementing the science curriculum

An analysis of the interviews shows that there are a number of factors that make it difficult for the process of implementing the program for S&T. Most Preschool teachers reported six main factors: a. Workload and lack of time. The Preschool teachers said that they must plan not to devote enough time to teaching science. Examples of teachers' statements about lack of time: "I do not always have time ... there are many activities I have to do during the day. I do not have enough time to do so much in groups" (2). "I have birthdays and other parties, there is no time for everything." (4) "I do engage in science, but not enough, not to the extent I would like. There are a lot of plans, a lot of demands. Not enough to do everything" (5). "I am so busy…" (7). B. Lack of manpower and partners in the practice of science. The teaches complain that they do not receive sufficient help in teaching S&T, and say: "Who will help me? Assistant can help "(2)." Sometimes parents cooperate .... Besides, my assistant helps me in the process ... that way I have no help "(4). "Lack of manpower "(7). "We have none. No related classes, nothing "(5). "Everyday I am alone" (8). C. Lack of scientific knowledge and skills for scientific education to young children. Examples of Preschool teachers' statements: "I have never undergone advanced training. In mathematics yes, and in science - no. The truth - I really want to, but no. I really want practical training" (2). "In science I do not know how to build it. Where to start? How to proceed? What is the order? … What process does the child go through in builfing his knowledge. I do not know where to start, what comes next, from what not to start" (8)." I lack knowledge and tools. I use my intuition"(5). "I don't know. Mostly what comes, not planned." (1). D. Lack of teaching materials adapted and appropriate for the level of a Preschool child. Teachers say: "We have test tubes that I dragged from some factory. I have a magnifying glass, a terrarium like this, an aquarium. What else do I have? This is it" (3). "I have nothing. A magnifying glass. (Laughs). I really have nothing" (8). "The truth is I don't have that much scientific equipment. I don't have any kit. I try to improvise every time. I don't have scales, I have magnifying glasses. I don't have binoculars ... I don't have a budget" (7).

E. Lack of familiarity with The program. Teachers say: "I am less familiar with the program itself. I have been exposed to many programs - apart from that of the Ministry of Education" (3).

Each of the Preschool teachers talked about at least one of the above six factors that harden in her scientific education. All the teachers (8) said that in the last five years they have not undergone any training in scientific education.

3.6 The Preschool teachers' attitudes towards teaching science in Preschool in relation to their implementation of the program.

All Preschool teachers who spoke about their positive attitude towards science, also spoke about the desire to engage in science and expressed enthusiasm from their scientific educational work. Yet their words show a gap between this desire for teaching science, and their actual implementation of this teaching.

Positive attitudes towards science were expressed in their words such as: "Science is one of my favorite fields. Through science you can teach a whole world and impart knowledge to children in all fields. It is a really deep experience because children deal with something real, tangible. I introduce science in almost each of my educational activities... through connecting to the animal and plant world, the children develop. Both in terms of cognition and in terms of sensitivity to nature. They learn important things, perhaps the most important things to know" (7). Another teacher said: "I strongly believe that science should be practiced ... I saw how happy they are to do all the processes. To experience it. It is very important. I know how significant it is for children ..." (6). The results obtained from the quantitative analysis show that there is a correlation between the Preschool teacher's attitudes towards teaching science in Preschool and the application of scientific activity in Preschool by her, meaning that Preschool teachers that showed positive attitudes towards science teaching indeed reported that they applied more science teaching in class. Expressing feeling comfortable in teaching science was almost identical to some sort of science teaching. But the picture regarding the implementation of the program itself is different. Most of the Preschool teachers (n = 5) who participated in the second phase of the study had a significant positive attitude towards the implementation of the S&T curriculum in Preschools. They defined the program as "an important program, a good program that can help the teacher in her work" (4), "should be implemented at both young and adult ages. The program addresses important topics like scientific language, phenomena ... it was wisely developed" (6) , "It's good to have a plan. The plan gives ideas and can help. Obviously it needs to be implemented" (3). In contrast, three teachers expressed their positive attitude with some הסתייגות, adding that "the plan is good. The plan should be implemented intelligently" (1), "One should be familiar with the plan. It is worth incorporating in class" (7), "Apply parts relevant to children" (7) or "probably need to apply it" (5). The teachers explained that "the plan is too general, not so clear and detailed" (8). We also found that Preschool teachers who have very positive attitudes toward science teaching say that they do not implement the program to the extent that they wished. Those teachers spoke of much teaching of science in class, at least several times a week, but not according to the S&T program. Examples: "... do not know exactly, but certainly implement something", (4), "I do not know. Maybe yes, intuitively" (8). "But I still try to bring in the matter of the sciences, because I think it's very important. I'm sure I will continue to do ... If it was up to me, I would be more engaged ... In my class I would do it all the time" (6). "The majority It's not what the Ministry of Education wanted me to do. " (1). I put science in every field ... it's in my head all the time ... I was not really able to teach according to what was written in the booklets ... but I am aware of things ... I really put science in every field. I might fulfill the dream. "(7).

**Discussion and recommendations**

In this study, the attitudes of Preschool teachers in relation to three main issues were examined: a. The Importance of Teaching Science in Preschool b. Application of S&T program of the Ministry of Education's in their class and c. The difficulties in implementing science teaching in general and program in particular by the teachers.

The results indicate that the basic attitude of Preschool teachers towards teaching science in Preschool is positive: Preschool teachers believe that it is important to teach science in early childhood. These results are consistent with the results of previous studies examining Preschoolers' attitudes toward teaching science in Preschool (Spektor-Levy et al., 2011; Hastürk, & Özdemir, 2021), also finding that most Preschoolers argue that early childhood education should begin, that young children can perform science activities in Preschool and marble This activity has a long-term positive effect on children's access to science.

We found positive correlations between the positive attitudes of the Preschool teachers regarding the importance of teaching science in the Preschool and the teacher's feeling of comfort in engaging in this teaching, as well as the level of application itself. This means that the more positive the teacher has about the importance of teaching science in Preschool, the more comfortable she is in doing so and the more she reports that she is implements teaching science in Preschool. Accordingly, we found negative correlations between the difficulty of the Preschool teacher in dealing with the challenges of science teaching in Preschool and the importance she sees in this teaching and the actual application of teaching, ie the more difficult Preschool teachers face the challenges of science teaching, the less important and less applied they are. Although the results show that Preschool teachers feel a great responsibility towards the child's needs (Maier, Greenfield, & Bulotsky-Shearer, 2013), and although they believe it is important to teach science in preschool, the extent to which the teacher applies this position is actually influenced by the teacher's personal comfort level and difficulty in teaching science (Saçkes, 2014).

The results of the study reveals a complex picture regarding science teaching in Preschool. Although most teachers include science activities into theirteaching, and believe that they must have adequate knowledge of the chosen field and the pedagogical skills necessary to teach scientific content and ideas to young children (Andersson & Gullberg, 2014; Thulin & Redfors, 2017), about a quarter of them are afraid that they will not know how to answer children's questions about scientific phenomena or principles, and about a third of them do not feel comfortable planning and presenting science-related activities in class. These teachers may feel that they have a lack of education or sufficient knowledge in science teaching and as a result they find discomfort, stress or fear in teaching certain content. These results are also consistent with previous studies (Greenfield et al., 2009; Spector-Levi et al., 2011; Yagmur-Kolcu & Öztuna-Kaplan, 2020) showing that

teachers that are very supportive of early childhood science education, feel they have insufficient scientific as well as pedagogic knowledge, and the result is that the readiness of Preschool graduates in scientific subjects may be lower than desired.

Clearly, according to the teachers, they do not implement scientific activities such as demonstrating experiments and research activities, as Spector-Levy (2013) also describes. At the same time, teachers choose the content and ways of teaching science intuitively, based on their knowledge and personal experience, but not on the program or its goals. In fact, only a small part of the plan is implemented and implemented in the field. Although all Preschool teachers claim that they engage in scientific content that most of them conform to the spirit of the program, and sometimes they even use the teaching methods that appear in it, they consciously use less appropriate teaching methods due to lack of time and inability to reach each child personally. This is due to the low self-efficacy of the Preschool teacher (Greenfield et al., 2009; Oppermann et al., 2021) and the multiple missions placed on the teachers.

The personal interviews enabled the teachers to detail a series of difficulties that prevent them from applying the program. One of the significant difficulties according to the Preschool teachers, is lack of familiarity with the program. Even if the teachers know about the program, they do not know its goals and content so they do not implement it but rather curricula such as mathematics, language, arts and events. The lack of knowledge of program indicates a negligible attitude towards it and perhaps a lowered priority by the teachers.

In order for Preschool teachers to be familiar with the program, the supervisory bodies must increase awareness of the program, and ensure the training and professional development of Preschool teachers to promote its implementation in the Preschool.

Another notable difficulty is the lack of time allocated by the teacher to teach science. Similar results have been obtained before (Greenfield et al., 2009), indicating an objective load, as there is a conflict between the need to carry out pre-planned activities according to the Preschool curriculum and the desire to address current events and occasional factors that are common in Preschool life ( ).

It has been found that in order to develop research skills and problem-solving abilities among young children, a long investment of time is required (Visone, 2009). The Preschool teacher is supposed to adapt the activities not only to the age but also to the level of development of all the children in the Preschool, and she often finds herself having difficulty "getting it all done". Similarly, U.S. Preschool teachers (Greenfield et al., 2009) reported low self-efficacy in science teaching and difficulty finding time to teach science, due to the burden placed on them in all areas of school readiness. The tuhal in MOT does not refer to the amount of time and frequency required for teaching science in Preschool and the Preschool teacher must determine both. It is possible that a dictated determination of the minimum time and frequency of activities can help the teacher in planning the entire teaching in the Preschool, and the teaching of the sciences in particular.

Preschool teachers report little knowledge in the field of content and in addition they feel they lack skills for teaching science to young children.

The results are consistent with the findings of others (Spektor-Levy et al., 2011; Yagmur-Kolcu & Öztuna-Kaplan, 2020) which indicate that only a minority of teachers feel confident about their personal knowledge in the sciences. The Preschool teachers themselves explain this by lack of proper training during their studies, and afterwards. Like researchers, they assume that effective professional development will lead to a significant improvement in the sense of comfort in teaching science (Greenfield et al., 2009; Visone, 2009; Spektor-Levy et al., 2011). This is supported by the works (Piasta et al., 2015; Furtado, 2010) which shows that professional training in science greatly advanced science teaching in Preschools. Such advanced training makes it possible to provide teachers with the confidence and knowledge required to teach science in Preschools according to principles that encourage the degree of research in which children perform experimental science activities (Andersson & Gullberg, 2014)). Proffesional training can also promote cooperation with other educators and thus overcome another difficulty noted by the Preschool teachers.

Another problem manifested by Preschool teachers is the lack of teaching materials and equipment for scientific research. At the same time, the Preschool teachers themselves say that they choose to purchase non scientific tools for the class. It may be that strengthening teachers' positive attitudes toward science teaching, as part of their training process, will encourage them to devote more resources to purchasing scientific aids and equipment. The Preschool teachers' ask to be more exposed to the education national publications and meet the מדריכים for scientific work in the Preschool so to establish a more positive attitude towards teaching science.

One of the limitations of this study is that it is conducted on a small scale of Preschool teachers teaching in the south of the country.

In conclusion, this study paints a complex picture that shows a gap between the desire of Preschool teachers to teach science and their recognition of the importance of the field, and the way in which they express this desire in their work. The factors that create this gap must be reduced so that the positions of the gardeners do not remain merely a statement.

The main recommendations arising from this study regarding the promotion of the application of S&T program in Preschools are as follows:

A. Conducting extensive training for Preschool teachers in order to impart the contents of the program and its goals and even more broadly to impart the field of scientific content, b. Update the staff in the Ministry of Education in order to address recommended schedules and its integration with other core programs in the Preschool, c. Equipment preschools with teaching materials and laboratory equipment for scientific research, as required by the program, d. Establishment of networks for professional advancement and social support of Preschool teachers, in which professional training will be held on scientific and other topics.

Networks of this type will promote teaching in Preschools in general and science teaching in particular the benefit of the preschool children, the citizens of tomorrow.

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personal interview

Personal details (name, seniority, education, details of the Preschool)

1. What scientific content have you taught in Preschool in recent years?

2. Details and descriptions of teaching methods and procedures that you use in teaching scientific content.

3. Describe in detail the learning environment in your classroom and what kind of scientific equipment it has.

4. Who are the partners in the educational environment in your class?

5. What is the average frequency of scientific activities in your garden during the year?

6. Are you familiar with the program of T&S in the Preschool?

7. Are you familiar with the goals of the program?

8. What do you think about tuhal in the Preschool?

9. Do you think that the tuhal should be applied in the Preschool?

10. What are your main difficulties in applying a tuhal in your garden?

Table 1

The importance of teaching science in Preschool

Feeling comfortable teaching science in Preschool

Implementation of scientific activities in Preschool

Teacher difficulties in teaching science in Preschool