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The effect of primary years program (PYP) on children's science process skills (SPS) in early childhood education

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Abstract

The aim of the current study was to investigate the effect of the Primary Years Program (PYP) on the science process skills (SPSs) of children in early childhood education. The study design was quasi-experimental and focused on children attending private schools in Istanbul. In this study, the Science Process Scale developed by Ozkan (2015) was used. Herein, approval for this study was granted by the Ministry of National Education, and consent was given by parents, to determine differences between their preschoolers who were attending an International Baccalaureate (IB) and Ministry of National Education school. Before implementing the PYP, a pretest was applied to the children in the experimental and control groups. After that, the children in the experimental group attended the PYP for 12 weeks. Conversely, the children in the control group attended the program of the Ministry of National Education. Following this 12-week period, the children were given a posttest. When the pretest results were compared after completing the IB program, there were no significant differences between the experimental and control groups. After the 12 weeks, a significant difference was found between the two groups with regards to their SPSs. When analyzed according to the factors, there seemed to be no differences between the two groups. However, at the end of the research, an interesting difference was found between the post and follow-up test results in the experimental group.

Key Words: International Baccalaureate, Primary Years Program, Science Process Skills, Preschool Education.

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1. INTRODUCTION

Established in 1968, the International Baccalaureate Organization (IBO) makes it possible for immigrant children to continue their education using the education system and assessment from their countries without any cultural degradation or language barriers, and further their education. Therefore, schools with an intention to become an IB school, need to organize themselves under four main titles. These include a multicultural understanding of education that emphasizes the students' change of intercountry places, the experiment of international methods in the national education system, international methods that are parallel to the traditional approaches, and the belief that universal standards that are required to be an IB school should be implemented in the school setting.

The IBO is a non-profit educational structure that proposes four different programs addressing the international arena, providing students with the ability to adapt to the globalized world and develop essential vital skills to become multidirectional individuals at the mental, social, personal, and emotional level (IB, 2015b).

The IB aims to cultivate young people who are inquirers, knowledgeable, and caring, and who will help to create a better and more peaceful world with intercultural understanding and respect. Hence, the organization works with schools, governments, and international organizations to develop compelling international education programs and disciplined assessments. IB programs encourage students from around the world to be effective, loving, and lifelong learners who understand that other people can have their own truths despite their differences (IB, 2014).

The structure of the IBO continued to evolve, as academics from various universities and teachers from different schools came together, and in 1969, the Diploma Program was founded. In 1990, a group of primary school administrators held a conference about the International School Curriculum Project, which dealt with the social work program of 3–12-year-olds (IB, 2013a). These studies, which support social development, have developed over time and have been combined with all disciplines within the program. Interculturality, communication, political processes, rules, rights and laws, social inequality, and discrimination have been included in these areas, which are based on secondary school students. With the development of the Middle Years Program (MYP) model in 1994, the contents of the IB program began to take their present form. Together with the MYP, the written, taught, and assessed parts were added to the curriculum model. With concepts, skills, attitudes, and action essential elements, the logic of inquiry began to take place. Between 1995 and 1997, the knowledge section was added to the essential elements for the Primary Years Program (PYP), and the question of which topics should be learned within the transdisciplinary units began to be addressed (IB, 2013a).

There are a number of factors that make up the PYP, which centers the student and contributes to making them effective lifelong learners (IB, 2016). The IB structure allows students to question the world, and develop a deep understanding of events and situations around the world. In doing so, it ensures that students are good communication specialists, respectful towards multiculturality, and caring and responsible individuals. At the same time, it contributes to developing a meta-cognition on learning to learn, so that the learners are open to evaluating themselves and their friends, where they approach events and situations from different perspectives. It also underlines that students are required to take the necessary constructive steps, not only for themselves, but also for the people around them, and that all individuals in the school are learning individuals.

2. LITERATURE REVIEW

1.1. PRIMARY YEARS PROGRAM

The PYP is an IB program aimed at developing an inquirer profile for children aged 3–12 years, comprising six transdisciplinary themes each year (IB, 2017b). This program aims to develop the knowledge, concepts, inquiry abilities, attitudes, skills, and actions needed for students to make sense of the world they live in as they develop their academic, social, and emotional situations (IB, 2009). In addition to language, mathematics, personal, social, and physical education, science, social sciences, and arts courses, which are considered to achieve this aim, various transdisciplinary themes enable students to gain international mindedness.

When the draft of the IB PYP was prepared, it was considered for primary school students, so that they would be active, lifelong learners in the use of unlimited resources, which are easy to reach in the globalizing world (IB, 2013c). For children born in the age of the Internet, being able to use technology properly, reaching a reliable source, and searching for information from various places were the basis of the PYP. Students are expected to be safe on different platforms, and through their learner profile features, it is aimed that they develop and become world citizens who form critical thinking skills via the unlimited access they have to information in today's world.

1.1.1. Values that Exist in the Basis of the PYP

The inquiry-based PYP curriculum model studies what and how the students will learn. These studies have shown that it is inevitable that students will make regular inquiries in order to understand the world (IB, 2007). The PYP curriculum supports the development of students in this way, expressing that the actions and social relations existing in their lives are not independent of each other.

PYP learners are expected to be frequently exposed to different and new learning experiences, develop their conceptual understanding, and discover their thinking skills. The PYP aims at bringing together related information and concepts, and allows meaningful information to be easily obtained by the students getting to know the unknown (IB, 2007). At the same time, the importance of this knowledge, acquired permanently by the students, is emphasized, for use in their lives, both at home and at school.

PYP schools, which are compelling, thought-provoking, and life-related and provide important experiences for students, allow students to take responsibility for their own learning and think about what they have learned. They also cause students to become inquirers, be curious, and care about, and interact with, their environment (IB, 2007). The teacher, who initiates the process and differentiates the planning through the inquiry plans, aims that the students are independent in the learning process and reach the transdisciplinary themes via a cooperative approach. PYP students, who are self-confident and improve themselves in all areas of development, attain the highest level of learning under the guidance of the teachers.

The scope of the IB's objective bulletin, set out with international mindedness, is to create a better and more peaceful world, through the features in the learner profiles, which will eventually be instilled in the students. (IB, 2007). The learner profile features that should be found in a student who has graduated from one or more of the IB programs are described as follows:

Inquirer: Curious and interested in learning. Enjoys being a life-long learner and acts independently in learning. Makes research from different sources.

Knowledgeable: Has an idea about global and national issues. Has vast knowledge about different topics. Shares what s/he knows.

Thinker: Recognizes problems using critical and creative thinking skills, and find solutions.

Communicator: Effectively and enthusiastically expresses feelings, thoughts, and information in different languages with confidence.

Principled: Is aware of general moral values and takes responsibility for his/her own actions. Treats himself/herself and his/her surroundings with feelings of righteousness, honesty, fairness, and justice.

Open-minded: Knows her/his own culture and history. Is open to the values and traditions of others and is accustomed to appreciating different perspectives and respecting others' thoughts.

Caring: Can put himself/herself in the place of others; is sensitive and caring about the needs and emotions of others. Tries to have a positive effect on the lives of others***.***

Risk-taker: Acts courageously in unusual situations and act independently to develop new strategies in the face of uncertainties.

Balanced: Knows that physical, mental, and spiritual health is important for him/her and others.

Reflective: Assesses his/her strengths and limitations, experiences, and learning.

These learner profile features, which are the basis of the IB programs, have a student-centered approach to education (IB, 2013b). The goal of all of the programs is to train students with an IB learning profile. For this reason, to achieve this goal, compelling, motivational education plans are prepared to enable individuals to have healthy connections in the school community, be strong communicators, collaborative workers, responsible, knowledgeable, flexible thinkers, ask questions, pursue interests, and enjoy learning. The stakeholders of the PYP program presented six transdisciplinary themes and their main ideas. The transdisciplinary themes that make students more profound in global issues, providing opportunities for researching, and inquiring different subjects are as follows (IB, 2007):

1. Who we are.
2. Where we are in place and time.
3. How we express ourselves.
4. How the world works.
5. How we organize ourselves.
6. Sharing the planet.

These concepts, centered on the international thinking system, carry students beyond thinking about one topic or theme. This understanding, which enables students to have expanded ideas about the world, consists of eight concepts (IB, 2007).

1. Form (What is it like?).
2. Function (How does it work?).
3. Causation (Why is it like this?).
4. Change (How is it changing?).
5. Connection (How is it connected to other things?).
6. Perspective (What are the points of view?).
7. Responsibility (What is our responsibility?).
8. Reflection (How do we know?).

In each unit of inquiry, three concepts must be given. When these concepts are paralleled by the lines of inquiry discussed, it opens the path to the aimed central idea. Filling these concepts with open-ended teacher questions constitutes a step to actualize the inquiry.
While students in PYP schools deepen in inquiry and advance in conceptual understanding, they also use them as tools for some of their skills while doing them (IB, 2007). These skills allow students to develop their core competencies and diversify their experience.
There are five basic skills in the units of inquiry at PYP schools (IB, 2007):

Research Skills:	Thinking Skills:	Communication Skills:
Formulating questions Observing Planning Collecting data Recording data Organizing data Interpreting data Presenting research findings	Acquisition of knowledge Comprehension Application Analysis Synthesis Evaluation Dialectical thought Metacognition	Listening Speaking Reading Writing Viewing Presenting Non-verbal communication
Self-management Skills:	Social Skills:	
Gross motor skills Fine motor skills Spatial awareness Organization Time management	Accepting responsibility Respecting others Cooperating Resolving conflict Groups decision-making	

Safety Healthy lifestyle Codes of behavior Informed choices	Adopting a variety of group roles

Allowing students to improve their skills in these five basic areas, while researching and inquiring, allows them to take a multidirectional approach to life.

The IB programs, founded on the mission of making the students become world citizens by creating international mindedness, aim not only to deal with the academic, cognitive, or physical abilities of the students, but also to reveal the personal and social values of the students positively. For this reason, there are some attitudes that students need to fulfill, in order, for their learner profiles (IB, 2007). These attitudes are:

1. Appreciation
2. Commitment
3. Confidence
4. Cooperation
5. Creativity
6. Curiosity
7. Empathy
8. Enthusiasm
9. Independence
10. Integrity
11. Respect
12. Tolerance

This attitude of the students' passion for life is not only realized as a role model (IB, 2007). The activities that deal with in the units of inquiry are intended to include these attitudes, to make the existing values of the students permanent in a challenging and related environment. These attitudes they possess and develop are encouraged both in and out of school.

It is expected that students will take a realistic step for themselves or their environment when the units of inquiry are finalized. It is predicted that students will be able to identify a problem or situation in relation to the unit and what kind of action or change may be caused personally for the problem or situation. The student can act after an internalized unit, whereas his/her inaction is also considered an action (IB, 2007). It is one of the essentials for making the PYP happen, as students show an attitude through reflection about life events and act by making a choice.

These actions can be carried out either directly through the students or through the guidance of adults. Students who get the opportunity to move ahead using small steps may be able to take action on a larger scale over time (IB, 2007). It is important for the students to pass through a successful unit of inquiry to care about what is happening around them, and reconcile their actions with values.

Assessment strategies and tools are among the most indispensable elements of the PYP curriculum. The purpose of these studies, which are often feedback on how students are doing and can do better throughout the learning process, is to see and sustain the progress. With meaningful and appropriate feedback, it is possible to know what the learner is learning at which level (IB, 2013b). This feedback, which provides true information for teachers and parents in the process, also allows the student to reflect about himself/herself (IB, 2007).

Assessment activities, which are part of the curriculum, help to reveal the success of the five essential elements of the PYP, which comprise knowledge, concepts, attitudes, skills, and actions in students (Harlen & Johnson, 2014). The results of these five essential elements in students are determined via assessment studies. For this reason, PYP assessment techniques do not use standard tests. On the contrary, they include open-ended strategies and tools that include teacher notes and developmental portfolios. Assessment components included in PYP schools are grouped under three main headings (IB, 2007). These are assessment, recording, and reporting.

1.2. PYP AND SCIENCE

Believing that the way of interpreting the world is through science and science applications, the PYP emphasizes the importance of science in the curriculum (IB, 2007). Systematic scientific studies are needed to study the physical, chemical, and biological structure of the world. It is possible for students to reflect on scientific knowledge, create meaningful information about the world, and participate in life in an effective and related way through scientific units of inquiry. Moreover, science applications have an important place in helping the students to gain a universal point of view and ensure that knowledge, concepts, skills, attitudes, and actions are adopted (IB, 2007).

The PYP plans prepared on the inquiry system already contain scientific processes. The PYP units of inquiry, which allow students to learn deeply through the context in which science is not taught only as lessons, encourage students toward open-ended research, curiosity, and persistent learning (IB, 2008). The PYP believes that permanent learning is based on student-initiated inquiries and deep research in teacher guidance, and matches science to concepts and skills. Inquiring causation and depth through concepts, the students also experience various scientific processes.

The scientific information processes in the context of the PYP unit of inquiries are as follows: (IB, 2008).

1. **Observe to collect information:** Closely observing the changes in living things, objects, and events.
2. **Use different tools to precisely measure the information:** Recording data using standard and non-standard tools.
3. **Use a scientific language to explain your observations and experiences:** Using scientific words to describe information about objects, creatures, and situations.
4. **Find or identify a problem or question to explore:** Identify questions or problems that are wondered about regarding the natural or physical environment and events.
5. **Plan and execute systematic reviews using variables as needed:** Testing two different variables for testing their results.
6. **Make predictions and test them:** Predicting an event or the next stage of a situation as a result of learning and observations.
7. **Interpret and evaluate the data collected for the conclusion:** Comparing, interpreting, and explaining the results of the different studies.
8. **Consider scientific models and applications of these models:** Presenting scientific findings using models and re-evaluating the information by reflection.

1.3. SCIENCE PROCESS SKILLS

It is important to raise the awareness of individuals in the field of science and technology, which develops due to changes in their social and individual lives. For this reason, it is important for individuals to acquire basic scientific knowledge and develop scientific literacy for correct interpretation (Özden, 2014, 146). When science literacy is earned at an early age, it enables students to develop science process skills (SPSs), develop effective solutions to problems, advance critical and creative thinking skills, and become inquirer individuals.

Science practices involve a number of processes that systematically bring together the information necessary to understand the world through science literacy (Hallez, 2008). It is important to use some tools to make the information used in everyday life meaningful and useful. "These tools that scientists use in their work are called science process skills" (Taşdemir, 2013, 4). SPSs, a sub-level of problem-solving skills, provide students with a critical perspective on the problems they face in their daily lives and contributes to the skills of inquiring events, deciding on issues, and analyzing and synthesizing problems. Furthermore, SPSs improve the ability to identify the problem being addressed, identify possible solutions, and use and interpret the appropriate one.

The basic SPSs consist of six steps (Özkan, 2015). These steps have been identified as observing, classifying, predicting, inference, communicating, and measuring (Hallez, 2008).

Observing: Observation, the most basic scientific process, is collecting information about objects or situations with the help of sense organs.

Classifying: Arranging objects, states, or events according to similarities, differences, and relational status.
Predicting: Predicting a situation as a result of observation or prediction.
Inferring: The process to come to a logical conclusion about the observed situation.
Communicating: Verbal, written and symbolic representations based on the data obtained in scientific studies.
Measuring: Measurement of the data obtained at the end of the observation using tools.

3. METHOD

3.1. Research Model

This study examined the effect of SPSs on preschool children in the PYP curriculum framework using a quasi-experimental research model. With this research, it was thought that the effect of the PYP on the observation, classification, prediction, inference, use of scientific language, and measurement skills of the students would increase. In this study, the Preschool Science Process Skills Scale and Demographic Information Form, developed by Dr. Banu Özkan (2015), were used.

3.2. Universe and Sampling

The children in the provincial center of Istanbul constituted the experimental group of children in a school implementing the IB program and a group of children in a school implementing the national curriculum. The 60–72-month-old children of these two institutions constituted the study group. Since it was intended to reveal the effectiveness of the method in the research, it is not necessary to select the sample from the universe in experimental pattern studies (Büyüköztürk, Çakmak, Akgün, Karadeniz & Demirel, 2010).

3.3. Data Analysis Methods

In the analysis of the data, descriptive statistics were presented as the mean ± standard deviation. Due to the small number of groups (n = 9) in the study and the non-parametric distribution (K-S, $P < 0.05$) of the scale scores, the analyses were examined using non-parametric analysis methods. The Mann-Whitney U test was used to compare the scale scores of the study groups. $P < 0.05$ was considered statistically significant ($\alpha = 0.05$). The analyses were conducted using IBM SPSS Statistics for Windows 22.0 (IBM Corp., Armonk, NY, USA).

4. RESULTS

4.1. Findings on the Differences between the Pretest Science Process Skills in Children in the Experimental and Control Groups

In this section, the pretest scores of the subscales of the Preschool Science Process Skills Scale for children in the experimental and control groups were examined.

The results of the Mann-Whitney U test obtained for the experiment and control groups in the preliminary test are presented in Table 4.1.

Table 4.1. Mann-Whitney U Test Results of the Differences between the Skill Levels of the General and Subscales of the Preschool Science Process Skills Scale Pretest of the Children in the Experimental and Control Groups

Scale (Pretest)	Group	n	X ± SD	U	P-value
Observation	Control	9	2.67 ± 1.00	0.12	0.92
	Experimental	9	2.56 ± 0.88		
Classification	Control	9	5.33 ± 1.41	0.26	0.79
	Experimental	9	4.78 ± 2.28		
	Control	9	5.33 ± 1.73	1.85	0.06

Prediction-Inference-Scientific Communication	Experimental	9	6.89 ± 1.76		
Measurement	Control	9	5.89 ± 1.27	0.83	0.34
	Experimental	9	6.33 ± 1.00		
General	Control	9	19.22 ± 2.54	0.93	0.31
	Experimental	9	20.56 ± 3.84		

In Table 4.1, the differences between the Preschool Science Process Skills Scale pretest scores of the children in the school that implemented the IB program and those in the school that implemented the national curriculum can be seen. In the Preschool Science Process Skills Scale Observation subscale, there was no significant difference between the average pretest score of the control group ($\bar{X}$ = 2.67) and that of the experimental group ($\bar{X}$ = 2.56) (U = 0.12; P = 0.92, P > 0.05).

In the Classification subscale, there was no significant difference between the average pretest score of the control group ($\bar{X}$ =5,33) and that of the experimental ($\bar{X}$ =4,78) (U = 0.26; P = 0.79, P > 0.05).

In the Prediction-Inference-Scientific Communication subscale, there was no significant difference between the average pretest score of the control group (which ranked 7.17) ($\bar{X}$ = 5.33) and that of the experimental group ($\bar{X}$ = 6.89) (U = 1.85; P = 0.06, P > 0.05).

In the Measurement subscale, there was no significant difference between the average pretest score of the control group ($\bar{X}$ = 5.89) and that of the experimental group ($\bar{X}$ = 6.33) (U = 0.83; P = 0.34, P > 0.05).

In the overall pretest scores of the Preschool Science Process Skills Scale, there was no significant difference between the control group ($\bar{X}$ = 19.22) and that of the experimental group ($\bar{X}$ = 20.56) (U = 0.93; P = 0.31, P > 0.05).

In general, it seemed that there was no difference between the levels of the Preschool Science Process Skills Scale and the general and subscales of the children in the study group before the start of the application process. The groups appeared to be equal before the implementation process.

4.2. Findings on the Difference Scores of Science Process Skills Scale Based on the Final Test and Pretest of the Children in the Experimental and Control Groups

In this section, the differences in the scores of the Preschool Science Process Skills Scale based on the final test and pretest of the children in the experimental and control groups was examined.

The Mann-Whitney U test results of the difference scores obtained by the experimental and control groups in the final test and the pretest are shown in Table 4.2.

Table 4.2. Mann-Whitney U Test Results of the Differences in the Skill Levels of the General and Subscales of the Preschool Science Process Skills Scale in the Final Test Difference Score of the Children in the Experimental and Control Groups

Scale (Pretest)	Group	n	X ± SD	U	P-value
Observation	Control	9	–0.22 ± 1.39	1.34	0.10
	Experimental	9	0.89 ± 1.05		
Classification	Control	9	1.00 ± 2.00	1.26	0.11
	Experimental	9	2.56 ± 2.01		
	Control	9	1.44 ± 2.19	1.89	0.06

Prediction-Inference-Scientific Communication	Experimental	9	3.33 ± 1.73		
Measurement	Control	9	–0.22 ± 0.97	1.05	0.16
	Experimental	9	0.33 ± 1.12		
General	Control	9	2.00 ± 3.57	3.48	0.01*
	Experimental	9	7.11 ± 3.10		

*Represents a statistically significant difference at $P < 0.05$.

In Table 4.2, the differences between the Preschool Science Process Skills Scale final test and pretest difference scores of the children in the school that implemented the IB and those in the school that implemented the national curriculum are presented. In the Preschool Science Process Skills Scale Observation subscale, there was no significant difference between the final test and pretest scores of the control group ($\bar{X}$ = –0.22) and that of the experimental group ($\bar{X}$ = –0.89) (U = 1.34; P = 0.101, P > 0.05). The results were almost the same in the experimental and control groups.

In the Classification subscale, there was no significant difference between the average final test and pretest scores in the control group ($\bar{X}$ = 1.00) and that of the experimental group students ($\bar{X}$ = 2.56) (U = 1.36; P = 0.11, P > 0.05). The results were almost the same in the experimental and control groups.

In the Prediction-Inference-Scientific Communication subscale, there was no significant difference between the average final test and pretest scores in the control group ($\bar{X}$ = 1.44) and that of the experimental group ($\bar{X}$ = 3.33) (U = 1.89; P = 0.06, P > 0.05) The results were almost the same in the experimental and control groups.

In the Measurement subscale, there was no significant difference between the average final test and pretest scores in the control group ($\bar{X}$ = –0.22) and that of the experimental group ($\bar{X}$ = 0.33) (U = 1.05; P = 0.16, P > 0.05). The results were almost the same in the experimental and control groups.

In the Preschool Science Process Skills Scale in general, there was a significant difference between the average final test and pretest scores in the control group ($\bar{X}$ = 2.00) and that of the experimental group ($\bar{X}$ = 7.11) (U = 3.48; P = 0.01, P < 0.05). Therefore, the Preschool Science Process Skills Scale difference scores for the final test and pretest were not same in the experimental and control groups. The SPSs of the experimental group, to which the PYP unit of inquiry is applied, seemed to be higher than those of the control group, which applies the Ministry of National Education (MEB) program.

5. CONCLUSION, DISCUSSION, and SUGGESTIONS

5.1. Discussion

From the results of this study, it was seen that the inquiry mentality of the PYP training program supported the scientific skills of the students.

In this study, a school that implemented the PYP and another school that followed only the MEB program were selected. The pretest scores of the children in these two schools were compared according to their initial SPS levels. As a result, there was no significant difference between the average final test and pretest scores in the control group ($\bar{X}$ = 19.22) and that of the experimental group (which ranked 10.78) ($\bar{X}$ = 20.56) (U = 0.93; P = 0.308, P > 0.05). Therefore, the Preschool Science Process Skills Scale scores in the experimental and control groups were almost the same for the final test and pretest.

The pretest was applied to these children who started learning in selected schools at the beginning of October. These children, the majority of whom have been in school for at least two years, had not been exposed to any PYP training until the first week of October. The pretest used in this period, when the children were getting used to the school environment and the educational program offered, tested the knowledge and skills that they already had. For this reason, it was seen that at the beginning, the two groups were equal to each other.

When the difference between the SPS of the final test difference scores of the children in the experimental and control groups was examined, it was seen that there was no significant difference between the sub-dimensions of the two groups. However, in the Preschool Science Process Skills Scale in general, there was a significant difference between the average final test and pretest scores in the control group ($\overline{X}$ = 2.00) and that of the experimental group ($\overline{X}$ = 7.11) (U = 3.48; P = 0.01, P < 0.05). Therefore, the Preschool Science Process Skills Scale difference scores for the final test and pretest were not same in the experimental and control groups. The SPSs of the experimental group, to which the PYP unit of inquiry is applied, seemed to be higher than those of the control group, which applies the MEB program.

An inquiry-based program was applied to the experimental group for 12 weeks. For the control group, a program based solely on MEB achievements was implemented. While the children in the experimental group were exposed to a comprehensive inquiry program that included SPSs (cooperative planning) by the teachers in the entire school community, the children in the control group remained within the scope of the science activities in the MEB plans. As a result of the study, it was determined that the PYP training contributed to the development of the SPSs of the children. However, it can be considered that the science education in the control group should be more inclusive and more supportive of scientific skills. At the same time, the children in the experimental group were provided with the IB standards in terms of physical equipment, a rich variety of materials, annual IB in-service training of the teachers, and regular testing meetings held by the PYP coordinator, and the teachers, all of whom had a positive effect on the advantages of the final test and pretest results of the experimental group.

All teachers working in IB schools work in a cooperative approach for unit planning. The plans implemented throughout the year are structured so that the classroom and single-subject teachers will address different disciplines on the same theme. For this reason, it is planned and arranged that the teachers to come together regularly (Güler & Yaltırık, 2011).

5.2. Conclusion

The results of the Preschool Science Process Skills Scale (Özkan, 2015) from the experimental and control groups were analyzed in this study. The scale consists of observation, classification, prediction-inference-scientific communication, and measurement subscales. According to the results of this scale, applied to students who studied and at an IB school and those who did not, there was no significant difference between the pretest results of either group. Despite the fact that there was no significant difference in the subscales of the test between the two groups according to the result of the final test after the application of the IB program, the overall result in the test was significant between the two groups. There was no significant difference between the difference scores obtained in the final test of the two groups when the final test was performed after three weeks.

5.3. Suggestions

Here, suggestions related to the findings are presented for researchers and teachers.

Suggestions for the Researchers

- The number of children in this study was equalized in terms of the experimental and control group. However, it can also be examined whether the gender dimension was equalized and whether the results differed according to gender.
- The number of children in the study was limited to those that were accessible. This study can be re-applied with a wider group and adapted to the generalization.
- The time interval applied for the trail test can be made longer for prolonging the test recall process for children.

- The correlation between the scores and socioeconomic levels of the parents can be analyzed.
- The relationship between the parental education levels and scores of the children can be observed.
- The effects of the PYP training program on social skills of the children can also be investigated.

Suggestions for the Teachers

- Teachers can be informed about scientific skills and why it is important that they be addressed in the preschool period.
- A short but effective training plan (such as interactive workshops) can be provided about how to apply the scientific skills recommended in the preschool period.
- An additional budget can be provided for the procurement of materials for science activities required for classroom environments.
- Guide books can be prepared for teachers who feel inadequate in this area.
- The contents of science activities in the preschool education program of the Ministry of National Education can be arranged at the base of the SPSs.
- Teachers can organize field trips so that they overlap with the topics they deal with, allowing children to make suitable and meaningful observations.
- A conceptual understanding of the how the world works can be developed by using inductive and deductive methods to improve the classification skills of the children.
- More cause-and-effect relationships can be provided with open-ended teacher questions and semi-structured planning that can improve the prediction-inference skills of the children.
- The children can contribute to their scientific communication skills by sharing their findings through a group and/or individual research with their classmates.
- Standardized and non-standardized measurement tools should be ensured, which children can experience on their own, in the center of science activities to enable the development of SPS in children.

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