



Simplifying of the Chemical Concepts for Talented Children in - Al-Jouf Region.

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Abstract

The present study focuses on using the museum education method to design models of learning activities for facilitating chemistry concepts in Sakaka, Al-Jouf region. This study aimed to train teachers of talented children in early childhood to simplify chemical concepts using the museum education method. The study used the lateral thinking scale with talented children to identify the effect of teacher training on the employment of various activities for museum education. It helped simplify chemical concepts for children in early childhood and measure their lateral thinking skills. The results presented the positive effect of using different museum activities to simplify chemical concepts on the lateral thinking skills of gifted children after training the teachers on how to present themes in a simplified manner.

Keywords: Chemical Concepts, Talented children, Lateral thinking skills, museum education method.

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Introduction

The first years of child's life are critical for later development. Children have a natural curiosity and an intrinsic motivation to inquire about the world around them. Young children have an inborn desire to learn; they want to explore, know how things work, and ask many questions. Developing thinking skills is one of the most valuable gifts we can pass on to our children. The simplest way to develop a child's critical thinking skills is by asking questions. Engaging children in inquiry learning fosters the development of research skills and prepares them for independent lifelong learning. They observe their world from different aspects and ask further questions. Children are powerful learners who must be actively engaged in mental activities such as investigating, organizing, processing, synthesizing, refining, and extending their knowledge of a topic (Willmott, 2006; Şahhüseyinoğlu, 2010). It empowers children to develop a widespread view that helps them become affected learners. In addition, students collaborate with peers, think deeply about complex concepts, relate new science content to their lives, and self-regulate their behavior. Further, it can bridge scientific and cultural ways of knowing the meaning of lives and the environment (Cuevas, Lee, Hart, & Deaktor, 2005; Dagher & Erduran, 2016).

Today, we need to be able to learn and understand the lived experiences of children. If children's minds are not actively generating questions and are not engaged in substantive learning, researchers and educators agree that science education can aid in this development in early childhood. Based on Vision 2030 for Saudi Arabia, education should be provided to children before primary school. Thus, this research is an early scientific intervention for the Al-Jouf teachers to develop talented children and thinking skills. Researchers, education professionals, and policymakers recommend teaching early science concepts in the

early years of children's lives. (Şahhüseyinoğlu, 2010; Åkerblom, Součková, & Pramling, 2018; Fridberg, Jonsson, Redfors & Thulin,2020).

The purpose of the study was to train teachers in Sakaka, Al-Jouf Region, to simplify the chemical concepts of talented children using the museum education method. The significance of this research lies in changing children's attitudes towards finding out about general science, especially chemistry, and enhancing their awareness of chemistry in daily life. In addition, teachers' attitudes concerning science in early childhood will shape children's engagement in science and develop their scientific curiosity. There is a wide gap in our knowledge of how scientific concepts may be incorporated into the curriculum and taught in early childhood and the best ways to 'simplify chemical concepts' in early childhood due to the lack of inquiry in early science education.

The importance of this research lies in understanding children's attitudes towards learning about general science, especially chemistry, and enhancing their awareness of chemistry in daily life. Ultimately, the intended goal is to spark an interest in studying chemistry for the future. Through the strategy of museum education, children can understand chemistry concepts easily.

Researchers emphasized that teaching children science during the early years is essential. Children in their early years should be provided with opportunities to create experiences in numerous fields and be supported in reflecting on scientific experiences. Researchers indicated that the majority of the participants believe that scientific education should begin in early childhood. Very young children will investigate and participate in the process of inquiry, and scientific activities in early childhood will influence children's long-term attitudes toward science. Observing, thinking, and actively engaging with scientific content touches upon children's natural sense of interests and experiences (French, 2004; Samarapungavan, Mantzicopoulos, & Patrick, 2008; Patrick, Mantzicopoulos, & Samarapungavan, 2009; Spektor-Levy, Baruch,& Mevarech,2013; Åkerblom, Součková, & Pramling, 2018).

The museum education method is essential in saturating children's curiosity with its sensory nature. Underlying educational activity within the museum is an understanding of education in this specific context as a form of active, free-choice learning that unfolds as a distinctive participatory experience within a museum's unique environment. These resources and activities certainly include guided visits, outreach programs, and teacher-orientation programs. However, they also comprise the creation and use of gallery aggregation, labels, audio guides, handouts, educational websites, and publications activities that museums put at the disposal of children to foster a better understanding and appreciation of the objects. (Hein, 2002; Akamca, Yildirim, & Ellez,2017; Brown, & Mairesse, 2018; Lachapelle, Zimmer, & Sinner, 2019; Sun,Wang & Li, 2019; Hackett, Holmes, & MacRae,2020; Görmez, 2020).

Therefore, researchers in this study suggested that early childhood teachers should be trained on how to teach science, especially chemical concepts, to develop their curiosity. There are deficiencies in training children at this stage on chemical concepts. Research on science education should explore the effectiveness of the museum education method of science education chemical concepts and their contribution to the development of scientific thinking, teacher training, and employment to nurture and arouse positive scientific engagement and scientific curiosity among children.

The literature on teaching children science, the importance of museums in children's learning, and the role of teacher training in achieving this:

Studies focused on teacher training to teach science in early childhood are based on models that include various participants in other regions. Sahnüseyinolu conducted the first paper in 2010. The study was concerned with evaluating the learning process of 6-year-old children in science by focusing on their experiences as children, their teachers, and the children's parents. Twenty-eight children from two classes in kindergarten participated in this study. The researcher collected data through observations and interviews with teachers and parents. The results indicated the children's continued motivation to learn and the persistence of their questions. The development of children's critical thinking was observed through their inquiries. When learning science, the most critical factor was constantly asking and verifying

questions (who, why, how, where, when and what). Child-based learning allows children to learn by doing and helps them in their lives to solve problems.

A study by Spektor-Levy, Baruch, & Mevarech (2013) was also concerned with preschool teachers' attitudes towards science learning and exploring their views on the nature of child curiosity and its promotion. The study was conducted with 146 preschool teachers. The results indicated that most of the participating teachers believe that learning science should start in early childhood due to the curious nature of children and that learning science at an early age can affect children's attitudes toward learning science later.

Communication between the teacher and the child plays an essential role in teaching science to children. The studies emphasized the role of teachers in thinking about ways to teach scientific concepts to children, not in the traditional ways that depend on language, but in ways that rely on experience and the performance of experiments and focus on the method of teaching scientific concepts to children. They also stressed the importance of the teacher's awareness of intermediate techniques and strategies for teaching children science early and using models to teach children scientific concepts, especially abstract concepts. The studies also indicated the early childhood teacher's role in teaching science to children. (Areljung, 2016; Thulin & Redfors, 2017; Fridberg, Jonsson, Redfors & Thulin, 2020).

The Swedish National Agency for Education (2019) emphasized the importance of the teacher's role and his responsibility for educational activities that enable children to play, be creative, explore, and learn, as well as and the importance of the teacher's role in developing and updating content in ways that are appropriate to the nature of this stage. He also stressed the importance of expanding children's knowledge, especially in childhood, to develop an understanding of each child's understanding of science in general and straightforward chemical concepts.

Lachapelle, Zimmer, and Sinner (2019) emphasized the importance of training teachers in museum education and the importance of these training programs being within formal education in Canada because of the significance and variety of activities carried out in the child's personality in general.

Among the studies that emphasize the role of museum education are those conducted by (Akamca, Yildirim & Ellez, 2017; Brown & Mairesse, 2018; Sun, Wang & Li, 2019; Hackett, Holmes, & MacRae, 2020). Museum education was used as an alternative learning method in early childhood. Teaching should extend outside of classrooms to boost learning. The program required learning techniques, and the environments were different from conventional ones. The present study aims to raise awareness about history through museum education. Data was collected at face-to-face interviews with a semi-structured interview form created to determine what children thought about museums. The obtained data were estimated with content analysis. The analysis demonstrated that the education program offered was adequate.

Methodology:

The current research used an experimental approach based on two groups, the control group and the experimental group, to determine the effectiveness of teacher training in simplifying chemical concepts. The researchers applied the museum education method to talented children in early childhood through pre- and post-measurement through the following set of procedures:

First, access previous studies related to the subject of the research to identify the results of the mechanism and use them to choose and design research tools and define chemical concepts that are appropriate for the nature of the stage of talented children in early childhood.

Second, apply the pre-measurement to measure lateral thinking on a sample of talented children aged 6–8 years in the "Center for Talented Children in Al-Jouf Sakaka" to know the level of lateral thinking skills they had. The research sample was divided into two groups (a control group and an experimental group). The division was made according to the parity between them in age, degree of intelligence, and level of lateral thinking. Traditional methods were used to teach the control group chemical concepts. As for the

experimental group, trainee teachers used chemical concepts to simplify these concepts using museum education.

The training program for female teachers used museum education to simplify chemical concepts. This was then applied to the dimensional measurement of the scale of lateral thinking for talented children and compared to the children of the experimental and control groups.

Finally, conduct statistical treatments to compare the degrees of talented children, extract and discuss results, and make recommendations relevant to the research subject.

Training Program for Early Childhood Educators:

The training program's objective was to train early childhood teachers to simplify some chemical concepts for children using museum education activities. This involved training children's teachers on selected scientific concepts and measuring their impact on children's lateral thinking.

The concepts covered by the program included green chemistry, solubility, separation of solutions, and chemical reactions.

Teachers were trained to use a variety of strategic methods. During the training, the researchers used the techniques of dialogue, discussion, brainstorming, models, and appropriate research. The training activities ranged from cognitive, skill-based, practical, and training activities.

In addition, the training sessions dealt with the importance of teaching chemical concepts in early childhood. Previous studies that enhanced the teaching of chemical concepts for children were reviewed and simplified using various museum activities, the appropriateness of each exercise to the presented chemical concepts, and the chemical concepts that were presented. It was dealt with through research, activities, and applying such research to children. Then, a post-application of the Lateral Thinking Scale for children was conducted.

Results and Discussion:

Equivalence in Lateral Thinking Skills:

The below table indicates significant differences between the mean degrees of the experimental and control groups in the pre-test of lateral thinking skills.

Table 1:

Significant differences between the mean degrees of the experimental and control groups in the pre-test of lateral thinking skills (n = 80)

Variables	Experimental Group (n=40)		Control Group (n=40)		Significant differences	
	Mean	Std. Deviation	Mean	Std. Deviation	t	Sig.
Generating new perceptions.	6.88	2.09	7.28	2.23	.828	.410
Generating new concepts.	5.58	1.66	6.00	1.89	1.066	.290
Generating new ideas.	5.73	1.88	6.08	1.82	.846	.400
Generating new alternatives.	5.95	1.81	5.70	1.56	.662	.510
Total Degrees of Lateral thinking skills	24.13	6.24	25.05	5.92	.681	.498

The previous table indicated no significant differences at the level of 0.05 between the mean degrees of the experimental and control groups in the pre-test of Generating New (perceptions, concepts, ideas,

alternatives) and total degrees of Lateral Thinking Skills. Figure 1 shows the bar charts for the mean degrees of the experimental and control groups in the pre-test of lateral thinking skills.

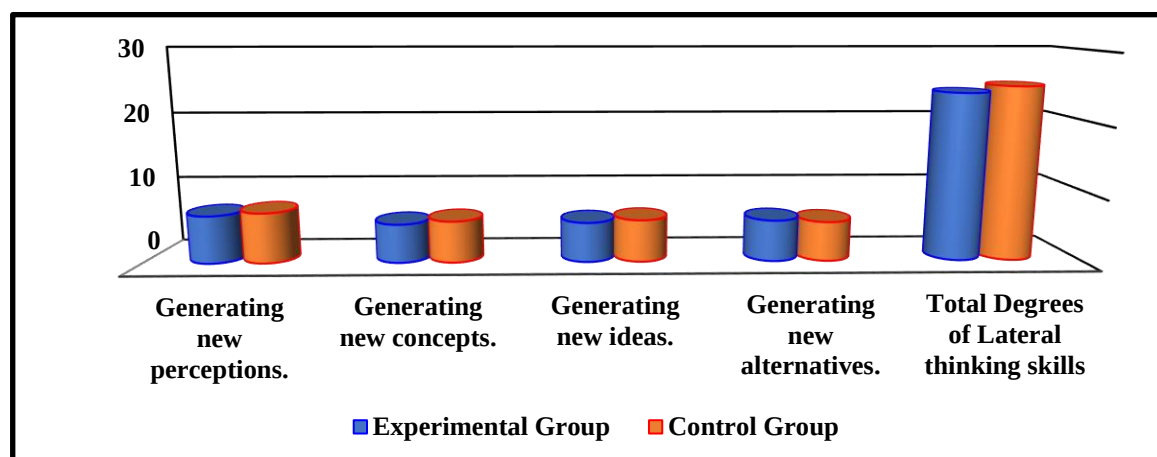


Figure 1:

The bar charts show the mean degrees of the experimental and control groups in the pre-test of lateral thinking skills.

Hypothesis 1: There are significant differences at the level of 0.05 between the mean degrees of the experimental and control groups in the post-test of lateral thinking skills in favor of the experimental group.

The below table indicates significant differences between the mean degrees of the experimental and control groups in the post-test of lateral thinking skills.

Table 2:

Significant differences between the mean degrees of the experimental and control groups in the post-test of lateral thinking skills (n = 80)

Variables	Experimental Group (n=40)		Control Group (n=40)		Significant differences		Effect Size (η^2)	
	Mean	Std. Deviation	Mean	Std. Deviation	t	Sig.	Value	Sig.
Generating new perceptions	11.25	1.06	8.53	1.72	8.523	.000	0.482	High
Generating new concepts	9.03	1.12	6.65	1.44	8.225	.000	0.464	High
Generating new ideas	8.90	1.15	6.93	1.94	5.538	.000	0.282	High
Generating new alternatives	9.30	1.22	6.35	1.90	8.249	.000	0.466	High
Total Degrees	38.48	1.89	28.45	4.95	11.961	.000	0.647	High

The previous table indicated significant differences at the level of (0.01) between the mean degrees of the experimental and control groups in the post-test of Generating New (perceptions, concepts, ideas, alternatives) and total degrees of Lateral Thinking Skills in favor of the experimental groups. Figure 2 shows the bar charts for the mean degrees of the experimental and control groups in the post-test of lateral thinking skills.

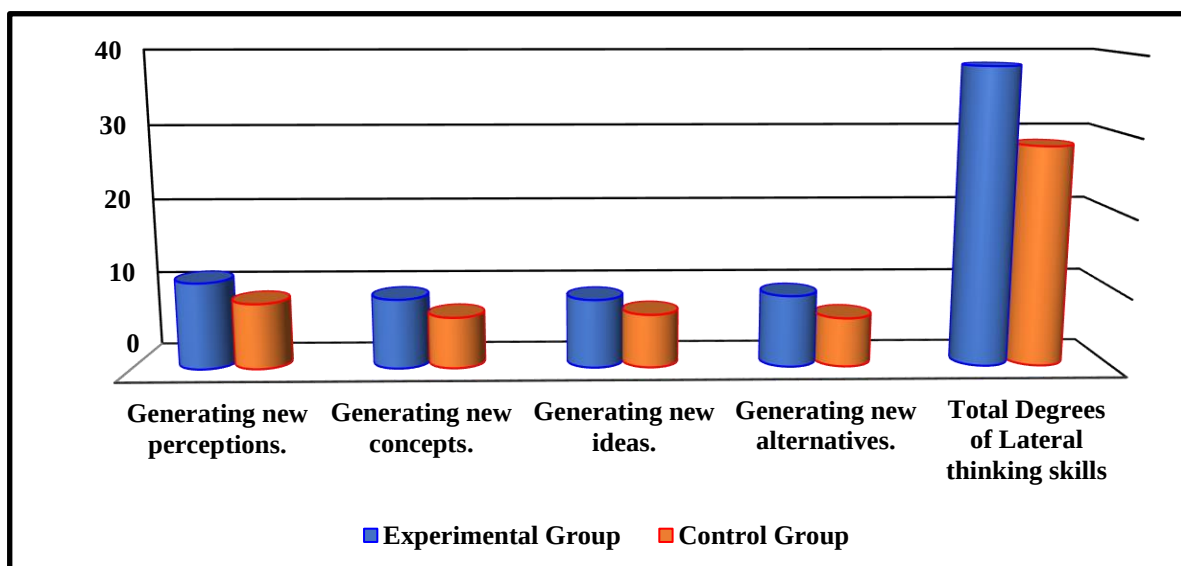


Figure 2: The bar charts for the mean degrees of the experimental and control groups in the post-test of lateral thinking skills

The effect size of simplifying the chemical concepts on developing new perceptions, concepts, ideas, alternatives, and total degrees of lateral thinking skills for talented children in the Sakaka community is high, according to Cohen's (1988) conventions for effect size.

Hypothesis 2: There are significant differences at the level of 0.05 between the mean degrees of the experimental group in the pre-test and post-test of lateral thinking skills in favor of the post-test. The below table indicates significant differences between the mean degrees of the experimental group in the pretest and post-test of lateral thinking skills.

Table (3):

Significant differences between the mean degrees of the experimental group in the pretest and posttest of lateral thinking skills (n = 40)

Variables	Pre-test		Posttest		Significant differences		Effect Size (η^2)	
	Mean	Std. Deviation	Mean	Std. Deviation	t	Sig.	Value	Sig.
Generating new perceptions	6.88	2.09	11.25	1.06	14.743	.000	0.848	High
Generating new concepts	5.58	1.66	9.03	1.12	10.216	.000	0.728	High
Generating new ideas	5.73	1.88	8.90	1.15	8.962	.000	0.673	High
Generating new alternatives	5.95	1.81	9.30	1.22	10.556	.000	0.741	High
Total Degrees	24.13	6.24	38.48	1.89	15.035	.000	0.853	High

The previous table indicated significant differences at the level of (0.01) between the mean degrees of the experimental group in the pre-test and post-test of generating new perceptions, concepts, ideas,

alternatives, and total degrees of lateral thinking skills in favor of the post-test. Figure 3 shows the bar charts for the mean degrees of the experimental group in the pretest and post-test of lateral thinking skills.

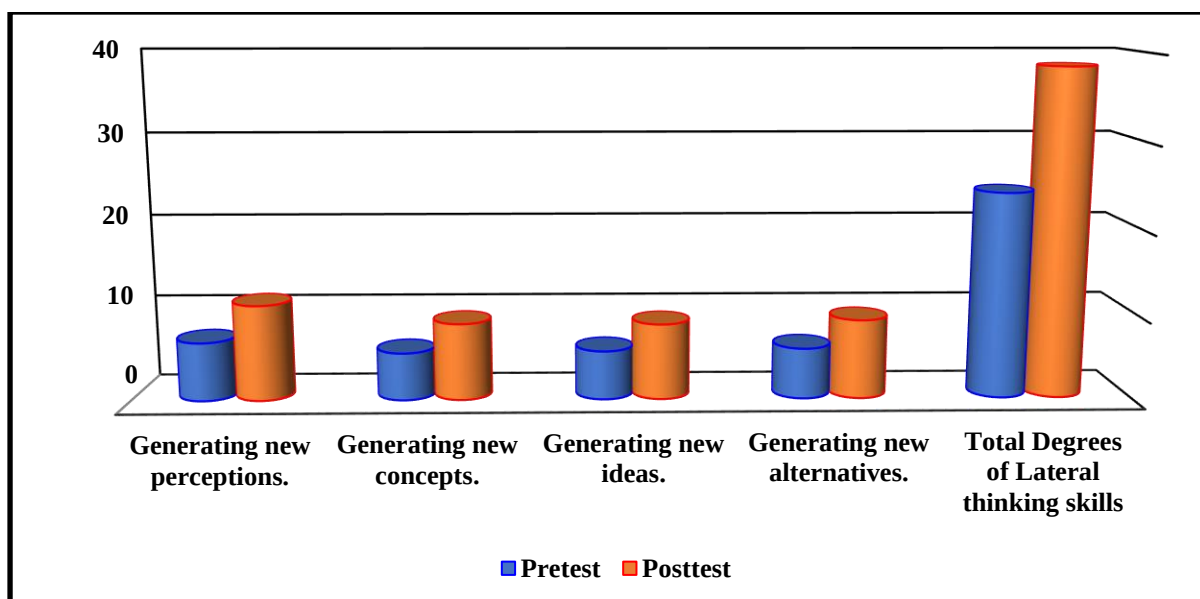


Figure 3: The bar charts for the mean degrees of the experimental group in the pretest and post-test of lateral thinking skills

The effect size of simplifying the chemical concepts on developing and generating new perceptions, concepts, ideas, alternatives, and total degrees of lateral thinking skills for talented children in the Sakaka community is high, according to Cohen's (1988) conventions for effect size.

Hypothesis 3: There are no significant differences at the level of 0.05 between the mean degrees of the experimental group in the post-test and follow-up test of lateral thinking skills. The below table indicates significant differences between the mean degrees of the experimental group in the post-test and follow-up tests of lateral thinking skills.

Table 4: Significant differences between the mean degrees of the experimental group in the post-test and follow-up test of lateral thinking skills (n = 40)

Variables	Posttest		Follow-up test		Significant Differences	
	Mean	Std. Deviation	Mean	Std. Deviation	t	Sig.
Generating new perceptions	11.25	1.06	11.53	1.11	1.317	.195
Generating new concepts	9.03	1.12	9.28	1.62	.763	.450
Generating new ideas.	8.90	1.15	9.18	1.41	.843	.404
Generating new alternatives	9.30	1.22	9.63	1.13	1.220	.230
Total Degrees	38.48	1.89	39.60	3.36	1.851	.072

The previous table indicated no significant differences at the level of 0.05 between the mean degrees of the experimental group in the post-test and follow-up test of generating new perceptions, concepts, ideas, alternatives, and total degrees of lateral thinking skills. Figure 4 shows the bar charts for the mean degrees of the experimental group in the post-test and follow-up test of lateral thinking skills.

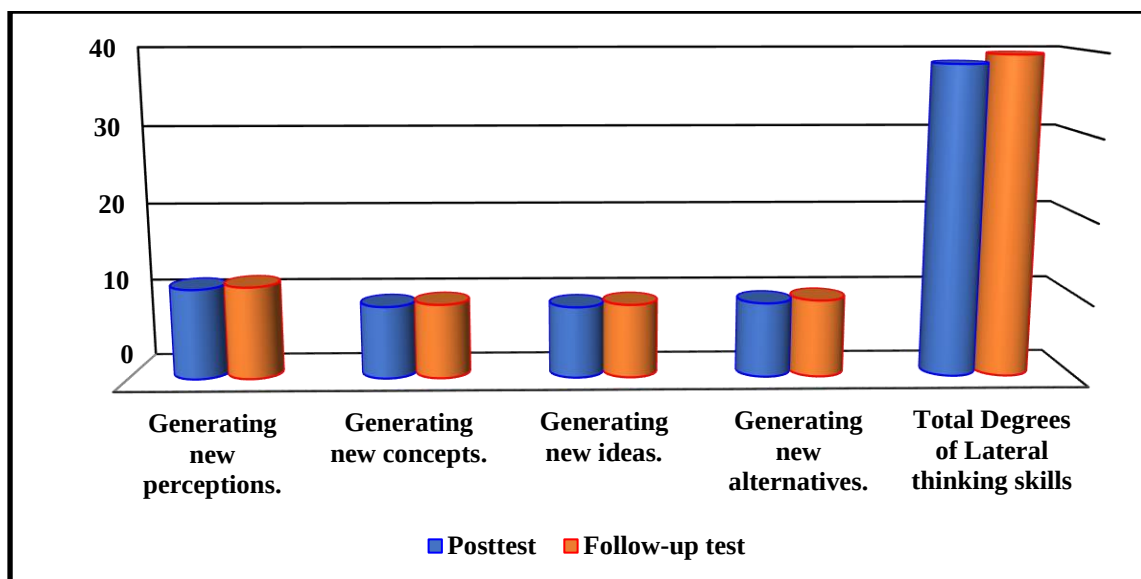


Figure 4: The bar charts for the mean degrees of the experimental group in the post-test and follow-up test of lateral thinking skills

Conclusion

Children in early childhood have the instinct of curiosity, exploration, and constantly asking questions about what is going on around them in the surrounding environment. They are young researchers by instinct, which has helped enhance children's thinking and generate new ideas, perceptions, and alternatives through observation, research, data collection, linking concepts, and making relationships. These characteristics of the child benefit in simplifying chemical concepts differently.

The teachers reported the importance of applying museum education to simplifying chemical concepts. The children of the experimental group interacted significantly and remembered what they learned, as museum education depends on the use of the senses in presenting chemical concepts. Their thinking became organized, despite the teachers' rejection that it would be difficult for them to learn some of the chemistry concepts at this early age and that they would not be able to acquire and absorb them. However, in this study, it was noticed from the children that they interact, participate, ask questions, and employ knowledge, their previous experiences, and the environment's capabilities to create new ideas and compete for them. The children's enthusiasm was not apparent at the beginning of the teacher's training.

The teacher's training helped to use the various museum education activities of models, activities, pictures, posters, live experiments, and the recycling of environmental materials to train children's thinking and stimulate the continuity of their curiosity through a set of various concepts that facilitate this, such as dissolving, separating liquid and non-liquid solutions, and the concept of green chemistry. The diversity of the use of chemical concepts in this study and the innovation and diversity of means of presenting them helped enrich children's thinking, help them generate new alternatives, and help them learn many thinking skills. Parents also praised that the children acquired many lateral thinking skills and had more questions. The children's progress was monitored before and after the teacher training and after they were trained for each child separately through the Lateral Thinking Skills Scale application.

We can conclude that the importance of supporting children, their knowledge, thinking skills, and continuity in motivating them to learn should be at an early age, which affects the formation of their habits and behaviors later and helps them better deal with the surrounding environment.

CONFLICT OF INTEREST

No conflict of interest.

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