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A Pilot Study for Developing Water Literacy of Preschool Children

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Abstract

In order to ensure the use, protection and sustainability of water, which is becoming more and more important for life, individuals need to develop their water literacy starting from the pre-school period. In this direction, it was aimed to improve the water literacy of 60-72 month old children who were in pre-school education with online education. In the study, action research design, one of the qualitative research methods, was used. The study group was determined by criterion sampling method and consists of 36 children aged 60-72 months. A semi-structured interview form was used as a data collection tool. In the study, Water Literacy Online Training was prepared and implemented in order to improve children's water literacy. Interviews were conducted with the children before and after the training. Content analysis was used in the analysis of the findings. As a result of the study, there had been improvement in the practical, living and social water literacy of the children. The results of the study showed that Water Literacy Online Training is effective in pre-school children's ability to recognize the importance of water, which is among the basic concepts for water literacy, for life, its limitations and the importance of its protection.

Introduction

Water has a key role in the survival of all creatures. However, the amount of water that can be used on earth is not evenly distributed (Moreno-Guerrero et al., 2020). In addition, changes in precipitation due to climate change and global warming cause a change in the distribution of usable water (Yu et al., 2021). Climate change, global warming and the state of the available water on earth are expressed as a global public health problem (Su et al., 2011). Although water resources do not increase, water use is constantly increasing due to population growth and the amount of usable water is decreasing due to pollution. In order to overcome the problems experienced, the use of water in our daily lives must be sustainable. However, environmental and social problems arise due to the unsustainable use of water (López-Alcarria et al., 2021). In order to eliminate these problems, improve the current situation and develop water in a sustainable way, new paradigms need to be considered. It is argued that the concept of water literacy is at the center of these paradigms (Otaki et al., 2015).

Being water literate means knowing how the water used in daily life is supplied, purified, safe and the amount of water we use daily (He, 2018). Water literacy is examined in three categories: practical, living and social water literacy. Practical water literacy; is to know to drink safe, clean water and not to drink unhealthy water. Living water literacy means the ability to use water wisely at home and in the garden. Social water literacy is acting responsibly for the society as a whole in terms of water use (Otaki et al., 2015). For the development of water literacy in individuals, interventions should be made for practical, living and social water literacy.

The most powerful intervention we have today for the development of water literacy is education (Åkerblom et al., 2019). The education on water literacy provides the opportunity to take sustainable measures related to water, to analyse the water problem well, and to produce effective and permanent solutions for the water problem in the education curriculum of children at all educational levels, starting from the pre-school period (Alicea-Planas et al., 2020; Lobato & Davis, 2019). The education curriculum should include the issues of economical use of water, water scarcity, the effect of water quality on human health, awareness of natural water resources that store water (Muntz & Kopp, 2019; Su et al., 2011).

The basis of the educational process is pre-school education. Preschool education is the educational process in which 0-6 year old children are included, covering the process before traditional education. In pre-school education, important foundations that shape the lives of individuals are laid. During this period, children's cognitive, social, emotional and language developments mature rapidly (İnan, 2012). In Turkey, 36-72 months old children are included in pre-school education. The Ministry of National Education Pre-School Education Program (MEB, 2013) in Turkey aims to ensure that children attending pre-school education institutions grow

up healthy through rich learning experiences, have the highest level of development in motor, social and emotional, language and cognitive development, develop self-care skills and enabling school readiness. While the education of children in the pre-school period is planned in line with the stated purpose, it is also important to raise individuals who are sensitive to the environment (Kaya Aydın, 2021). The inclusion of water literacy education in the curriculum from the pre-school period enables children to meet water-related problems early and acquire skills to prevent this problem early (Meehan, 2021). The knowledge, skills and attitudes taught in the pre-school period are more easily adopted and permanent than those taught at later ages (Bhise, 2020). For this reason, the education given in the pre-school period allows the development of water awareness in the society from an earlier age and water literacy settles in the society. Studies have shown that the education given to pre-school children on water conservation (Samaltani & Christidou, 2013), water literacy and awareness (Ursavaş & Aytar, 2018), fisheries awareness (Kılınç et al., 2016) and water cycle (Ahi, 2017) has been effective. Although important issues related to water were mentioned in these studies, no planning was made for the development of all categories of practical, living and social water literacy of children in the content of the education they provided. In addition, giving education in a formal environment can make it difficult to control whether the acquired knowledge, skills and behaviours are transferred to the home environment where children interact with water the most. Based on these identified situations, the trainings on water literacy should include all categories of practical, living and social water literacy. In addition, the fact that children receive this education in the home environment makes it easier for them to act. In this direction, it was aimed to improve the water literacy of 60-72 month old children who were in pre-school education with online education.

For this purpose, answers to the following questions were sought:

- What were the views of the children in the study group about water literacy before online education?
- Was there a change in the views of the children in the study group about water literacy after the online training?

Method

Research Design

In the research, action research design, one of the qualitative research methods, was used. It is a pattern that includes practices such as creating changes in the behaviors, attitudes, perceptions or value systems of the participants. Technical/scientific/collaborative action research is one of the types of action research. In technical/scientific/collaborative action research, a new approach is applied and analyzed, application-oriented evaluation is made and the implementation process is defined. (Yıldırım & Şimşek, 2013). This study was thought to be suitable for action research in terms of the implementation of Water Literacy Online Training, interviewing and evaluation before and after the application.

Study Group

The study group consisted of 36 children aged 60-72 months who were receiving pre-school education. Criterion sampling, one of the purposive sampling methods, was used in the selection of the study group. The basic criteria were that children are attending pre-school education, they were 60-72 months old, they had internet access at home, they had a computer or tablet where they could participate in online education, and they could be accompanied by an adult to support the child during online education.

When the demographic characteristics of the children in the study group were examined, it was seen that 47.3% were girls and 52.7% were boys. 22.2% of the children's mothers were secondary school graduates, 52.8% high school graduates, and 25.0% university graduates. 5.6% of their fathers were secondary school graduates, 47.2% were high school graduates, and 47.2% were university graduates. 13.39% of mothers were civil servants, 2.8% were workers, 2.8% were self-employed and 80.5% were housewives. 27.8% of fathers were civil servants, 27.8% were workers and 44.4% were self-employed. 38.8% of the families had a high income and 61.2% have a medium income.

Data Collection Tools

Personal Information Form and Interview Form were used as data collection tools.

Personal Information Form

The form was created by the researchers and filled out by parents. In the form, there were questions about the gender of the children, the educational status of the parents and their occupation and income.

Interview Form

A semi-structured interview form prepared by the researchers was used in the study. Before creating the data collection tool, the relevant literature was searched. A data collection tool consisting of six open-ended questions was created. The questions in the interview form were grouped under three themes: practical, living and social water literacy. These three themes cover the following: knowing the concept of water, its source, drinking safe and clean water and not drinking unhealthy water, using water sparingly in daily life, acting as a community for water use, finding a solution to the water problem. The interview form was examined by three field experts. Adjustments were made in line with the recommendations of the experts. The interview form was applied to two children who were not in the study group. Afterwards, the interview form was given its final form. The interview form was applied both before and after the Water Literacy Online Training.

Water Literacy Online Training

The Water Literacy Online Training (WLOT) was created by researchers in order to improve the water literacy of 60-72 months old children. Before the WLOT was created, the relevant literature was scanned. In order to develop water literacy, it was thought that it was necessary for children to acquire the knowledge and skills of knowledge about water and water resources, the amount of water use in daily life, and the awareness of finding solutions to the water problem. In this direction, WLOT was planned by the researchers to include activities for practical, living and social water literacy categories. The activities were prepared by using the acquisitions, indicators, concepts, activity types and formats in the Preschool Education Program of the Ministry of National Education (MoNE, 2013). Turkish-language, science, drama, play, music and art activities were included in WLOT. Five activities were prepared for practical water literacy, six activities for living water literacy and five activities for social water literacy. WLOT was presented to the opinion of three field experts, and WLOT was given its final form in line with the suggestions received. One activity from each category of WLOT was selected and a preliminary application was made to the children who were not included in the study group. After the pre-application, the activities were rearranged and the WLOT was given its final shape.

Implementation of WLOT

WLOT was administered to children twice a week for eight weeks. The activities were implemented online by connecting the children with the Zoom application. The application was made by dividing the children into seven groups of five and six each in order to better interact with the children. The groups did not change throughout the training program. All groups were treated for eight weeks, two sessions per week. Each session lasted approximately 40 minutes.

Data Collection

Data were collected through interviews before and after the WLOT was applied. Interviews were carried out with one-on-one video calls over the zoom application when the children were available. During the interviews, the parents were told that there should not be an environment that would distract the children's attention. With the support of the parents, a suitable environment was created for the interviews. Interview questions were carried out before and after the implementation of WLOT. Interviews lasted approximately twenty minutes with each child.

Ethical Approval

Ethical Approval was obtained from Afyon Kocatepe University Social and Human Sciences Ethics Committee (2021/281).

Data analysis

The data were analyzed by content analysis technique. In this technique, concepts related to the collected interview results are formed, similar concepts are brought together and themes are formed (Yıldırım & Şimşek, 2016). In the analysis of the data, the steps of organizing and preparing the data, making general sense of the information, coding, defining, representing and interpreting were used respectively (Creswell, 2013). The interviews were converted into written text. The obtained data were read and coded by the researcher. The data were evaluated and coded by another expert in the field. The different encodings were again negotiated and changed. The data were organized according to codes and themes. The findings that emerged as a result of examining the themes were reported by quoting directly from the views of the participants (Yıldırım & Şimşek, 2016). Theme and category tables for the coding were created. The obtained data are also presented in the text as frequency values. In the study, children were selected as C1, C2, C3, C4 etc. and analyses were presented with these codes.

Validity and Reliability

In order to ensure the internal validity of the obtained data, diversification, expert review, participant confirmation and long-term interaction methods were used. In order to ensure external validity, the data obtained were analysed without adding comments and without disturbing the nature of the data. For reliability, coding reliability was calculated. The obtained data were analysed by two independent researchers and the agreement between encoders was calculated as .88 using the consensus-disagreement formula (Miles & Huberman, 1994). Since the agreement percentage was higher than .70, it was decided that the results obtained were reliable.

Results

The data obtained from the study were gathered under the main headings of practical, living and social water literacy and presented in tables below.

Practical Water Literacy

Table 1. Themes and sub-themes related to the concept of water

Pre-Interview				Post Interview			
Theme	Subtheme	f	%	Theme	Subtheme	f	%
drink	drink (f=15)	20	48,78		Source of life for people (f=15)		
	drinking water (f=5)						
life	Life source (f=4)	6	14,63	life	Source of life for animals (f=3)	20	45,45
	life (f=2)						
cleaning	cleaning (f=4)	6	14,63		Source of life for plants (f=2)		
	bath (f=1)						
	handwash (f=1)						
nature	nature (f=2)	3	7,33	health	health (f=2)	6	13,64
	rain (f=1)						
other	water (f=2)	6	14,63	need	people's need (f=12)	13	29,55
	surname (f=1)						
	beautiful (f=1)						
	health (f=1)						
total	Everything (f=1)	41	100,0	conservation	keeping water clean (f=2)	3	6,81
					water conservation (f=1)		
				important	Everything (f=1)	2	4,55
				important (f=1)			
				total		44	100,0

In order to evaluate practical water literacy, the children were asked “What is water/What comes to mind when you think of water?”, “What is the source of water/Where does the water come from/Where does it go?”, “How

is/what is clean water?" questions were posed. When Table 1 was examined, it was seen that the answers given by the children regarding the concept of water in the pre-interviews were grouped under the categories of "drink, life, cleanliness, nature and other". In the post interviews, it was seen that they were gathered under the themes of "life, health, need, important". It was noteworthy that the children gave more detailed answers to the concept of water in the last interviews. While most of the children expressed their opinion that water was a drink in the pre-interviews, it is noteworthy that in the post interviews they emphasized that water was the source of life for all living things, that it met the needs of living things and expressed its importance in terms of health. Examples from children answers in the pre and post interviews regarding the concept of water were as follows:

- C2. It is the drink that is our source of life. (Pre-interview)
- C18. It is our source of life. (Pre-interview)
- C7. Water is very useful. It protects people from diseases. It is the source of life for animals and plants. (Post interview)
- C24. It is necessary for the survival of plants. It is our source of life. It keeps us clean. (Post interview)

Table 2. Themes and sub-themes related to the source of water

Pre-Interview		Post Interview					
Theme	Subtheme	f	%				
natural source	rain (f=4)	10	27,80	natural source	rain (f=6)	18	45,0
	underground (f=3)				cloud (f=4)		
	cloud (f=1)				underground (f=4)		
	river (f=1)				sky (f=2)		
	runnel (f=1)				nature (f=1)		
fountain	faucet (f=5)	10	27,80	artificial source	sea (f=1)	22	55,0
	fountain (f=4)				barrage (f=11)		
	washbasin (f=1)				waterworks (f=11)		
artificial source	barrage (f=4)	8	22,20	total		40	100,0
	conduit (f=2)						
	sewage (f=2)						
no answer	no answer (f=8)	8	22,20				
total		36	100,0				

When Table 2 was examined, it was seen that the answers given by the children in the pre-interviews about where the water came from were gathered under the themes of "natural source, fountain, artificial source" and eight children did not answer. In the post interviews, it was seen that they were gathered under the themes of "natural source and artificial source". When the answers given by the children in the pre-interviews were examined, it was seen that they referred to the elements they saw in their physical environment regarding where the water came from. However, when the results obtained from the post interview were examined, it was seen that the children expressed their opinions about the water cycle, the place where the water is purified and the place where it is stored. Examples from children answers in the pre and post interviews about where the water comes from were as follows:

- C3. It's coming from the faucet. (Pre-interview)
- C17. It's coming from the pipes. (Pre-interview)
- C18. Underground water evaporates and comes as rain. (Post interview)
- C27. The water is cleaned in water treatment plants and comes back. (Post interview)

When Table 3 was examined, it was seen that the answers given by the children in the pre-interviews about how clean water was, were gathered under the themes of "clean water, clean appearance, potable water, nature". It was noteworthy that 15 of the children did not respond in the preliminary interviews. In the post interviews, it was seen that they were gathered under the themes of "health, beneficial content, potable water". In the pre-interviews, the children mostly made statements about the physical characteristics of clean water. In the post interviews, the children gave answers about the benefits of clean water for health, not containing microbes, containing beneficial minerals and being drinkable. Examples from children answers in the pre- and post-interviews about how clean water was:

- C7. It is bright, visible water. (Pre-interview)
 C20. It is water without garbage and mud. (Pre-interview)
 C2. It is purified water with beneficial minerals in it. (Post interview)
 C8. There are no microbes. It doesn't make you sick. It is drinkable. (Post interview)

Table 3. Themes and sub-themes related to the concept of clean water

Pre-Interview				Post Interview			
Theme	Subtheme	f	%	Theme	Subtheme	f	%
clean water	clean (f=4)	7	19,44	health	sterile (f=18)	50	58,82
	sterile (f=2)				beneficial (f=5)		
	Handwash water (f=1)				healthy (f=13)		
	waste-free water (f=2)				not sick (f=12)		
clean appearance	bright water (f=2)	6	16,67	beneficial content	clean (f=2)	20	23,53
	sludge-free water (f=2)				water with beneficial minerals (f=12)		
	visible water (f=2)				chemical-free water (f=10)		
potable water	potable water (f=4)	5	13,89	potable water	potable water (f=7)	15	17,65
	bottled water (f=1)				purchased water (f=1)		
nature	Nature water (f=1)	3	8,33	total		85	100,0
	sea water (f=1)						
	water where fish live (f=1)						
no answer		15	41,67				
total		36	100,0				

Living Water Literacy

In order to evaluate living water literacy, the children were asked, "What is water saving/What comes to mind when you say water saving? What do you do at home to save water?" questions were posed.

Table 4. Themes and sub-themes related to water saving

Pre-Interview				Post Interview			
Theme	Subtheme	f	%	Theme	Subtheme	f	%
not waste water	not waste water (f=4)	12	33,33	not waste water	not waste water (f=11)	21	58,33
	not leaving the water on (f=3)				not leaving the water on (f=4)		
	close the tap (f=3)				close the tap (f=4)		
	urning off the water while washing hands (f=2)				not using unnecessary water (f=2)		
small amount of water use	don't use too much water (f=2)	3	8,33	small amount of water use	use less water (f=5)	15	41,67
	don't turn on the water too much (f=1)				use water carefully (f=3)		
saving	not waste (f=1)	2	5,56	saving	watering flowers with used water (f=3)	15	41,67
	saving (f=1)				watering the garden with little water (f=2)		
no answer	No answer (f=19)	19	52,78		Not turn off the water while brushing teeth (f=2)		
total		36	100,0	total		36	100,0

When Table 4 was examined, it was seen that the answers given by the children to what/how to save water in the pre-interviews were gathered under the themes of "not wasting water, using a small amount of water, saving", and in the post interviews "not wasting water, using a small amount of water". Although the themes were the same, 16 children stated that they did not know how to save water in the pre interview, and that there was no child who did not know in the post interviews. In addition, it was noteworthy that in the post interviews, children gave detailed information about water saving. Examples from children answers in the pre and post interviews on water saving were as follows:

- C1. Don't waste water. (Pre-interview)
- C16. Turning off the water while washing our hands. (Pre-interview)
- C17. Watering the flowers with the water we use in our garden. (Post interview)
- C20. Do not use unnecessary water. Do not leave the water on. (Post interview)

Table 5. Themes and sub-themes related to what they do to save water

Pre-Interview				Post Interview			
Theme	Subtheme	f	%	Theme	Subtheme	f	%
not waste water	use less water	9	25,0	not waste water	brushing teeth while washing hands (f=6)	29	59,1
	don't leave the taps open				not to waste water (f=5)		
	turn off water				using the washing machine less (f=3)		
no answer	no answer	27	75,0		turn off water (f=4)		8
total		36	100,0		not waste water (f=3)		
					closing the taps (f=3)		
					Not washing the dishes before putting them in the machine (f=3)		
					turn on the water less (f=2)		
					rainwater storage (f=8)		
				water conservation	watering flowers with little or used water (f=6)	20	40,8
					water used in the sink for garden irrigation, balcony washing (f=6)		2
				total		49	100,0

When Table 5 was examined, the answers given by the children in the pre-interviews about what they and their families do to save water were gathered in the category of "not wasting water". 27 children said that they did not know what they did at home to save water. In the post interview, the answers were gathered under the themes of "not wasting water and water conservation ". In the pre-interviews, it was seen that most of the children did not know how to save water, and the respondents only focused on the amount of water use. In the post interviews, it was seen that answers were given about the amount of water use and wasting water, as well as the evaluation of used water. Examples from children answers in the pre and post interviews about what they do to save water were as follows:

- C3. We never leave the taps open. (Pre-interview)
- C32. We use less water. (Pre-interview)
- C36. We collect the water with which we wash the vegetables and wash the balcony. (Post interview)
- C26. We do not wash the dishes with water before putting them in the machine. (Post interview)

Social Water Literacy

In order to evaluate social water literacy, the children were asked, "What do you do to protect water?" question was posed. When Table 6 was examined, the answers given by the children about what they can do to conserve water in the pre-interviews were gathered under the themes of " water conservation, protecting water, water storage". In the last meeting, the themes of "Using less water, making new inventions, informing the public" were gathered. In the pre-interviews, children's views on using water sparingly, protecting clean water and accumulating rainwater. However, in the pre-interviews, 22 children could not answer this question by saying that they did not know. In the post interview, it was thought that all children answered the questions and thought about innovations for water saving as well as using less water and making plans to inform the public, which is an indicator of the development of social water literacy in children. Examples from children answers in the pre and post interviews about what they can do to conserve water were as follows:

- C8. If everyone left the waters on, I would turn off all the waters. (Pre interview)

knowledge of children on this subject (Ahi, 2017). It is seen that the results of the studies given above overlap with the results obtained from this study regarding practical water literacy. Since practical water literacy includes the information that children encounter in their daily lives, it is thought that children's knowledge develops easily after the education given. It is considered that children's basic knowledge about water, which is in danger today, will be effective in developing policies for water conservation and water protection.

Living water literacy is the ability of children to consume water wisely in daily life without wasting it (Otaki et al., 2015). Since the amount of water we can use in the world is limited, the importance of using water carefully should be explained to children starting from the pre-school period (OECD, 2015; UNESCO, 1994). In order to evaluate the living water literacy level of children, questions and activities were prepared about their knowledge about water saving and what can be done for water saving. In the post interview, there were no children who could not answer about the living water literacy, and the answers of the children about the living water literacy varied. It had been observed that the knowledge and awareness of the children after the application of WLOT was higher than before the application. This result showed that WLOT was effective in developing children's living water literacy. No studies had been found in the literature that directly examine living water literacy. For this reason, studies on water saving that support the results of the study are included. Wagner and Pramling Samuelsson (2019) emphasized that water, water conservation and sanitation education given to preschool children is necessary to have a more sustainable environment. Children who had knowledge about water saving and water cycle in the pre-school period acted more responsibly in later life (Bhise, 2020; Lake & Adinolfi, 2017). Water awareness training for pre-school children expands children's knowledge of water conservation and increases water conservation practices (Miller et al., 2014).

Social water literacy, on the other hand, includes acting responsibly for the society in paying attention to water use and producing solutions to the water problem. Although the acquisition of social water literacy is a long process, its foundations should be laid starting from the pre-school period (Otaki et al., 2015). For this reason, the concept of water conservation within the scope of social water literacy was discussed in the study. Training and interview questions on water conservation were prepared for children to evaluate this issue. In the pre-interviews, most of the children left the questions unanswered. It is noteworthy that in the post interviews, children planned innovations related to water conservation and water saving, and emphasized the need for studies to inform the public. Our results are in line with the results of the Papadopoulou and Christidou (2004) study to raise awareness of water conservation in preschool children. It also overlaps with the results of Bourtozoglou et al. (2016) studies in which children develop their knowledge of water sustainability. Ursavaş and Aytar (2018) concluded that after the training they gave, the ideas of children's water conservation developed.

As a result of the study carried out with the aim of improving the of 60-72 month-old children receiving pre-school education with Water Literacy Online Training (WLOT), it had been determined that there was improvement in children's practical, living and social water literacy. The results of the study showed that WLOT was effective in pre-school children's ability to recognize the importance of water, which was among the basic concepts for water literacy, for life, its limitations and the importance of its protection. In line with this result, it may be necessary to develop the water literacy of individuals starting from the pre-school period in order to ensure the use, protection and sustainability of water, which is becoming increasingly important for the life of living things. can be said.

Recommendations

- In the study, WLOT was applied online and it was found to be effective. It may be suggested to prepare intervention programs using different methods.
- In the study, the application was applied twice a week for eight weeks. The effectiveness of the study can be increased by extending the application period.
- A semi-structured interview form was used as a data collection tool in the study. The results obtained from the study can be varied by using different data sources and data collection tools.
- Children's water literacy should be followed in the following years and supported with high-level achievements.
- Although positive results were obtained by applying the study online to small groups, the generalizability of the results should be ensured by applying a large sample.
- Reliable measurement tools should be developed to evaluate the water literacy of preschool children.
- All individuals in the society should be informed about water literacy.

Scientific Ethics Declaration

The authors declare that the scientific ethical and legal responsibility of this article published in JESEH journal belongs to the authors.

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