

STUDENTS' EMOTIONS, THOUGHTS, AND PERCEPTIONS ABOUT ENDANGERED FROGS

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Received: February 11, 2025

Accepted: April 24, 2025

Published: April 30, 2025

Suggested Citation:

Özarslan, M. (2025). Students' emotions, thoughts, and perceptions about endangered frogs. *International Journal of New Trends in Arts, Sports & Science Education (IJTASE)*, 14(2), 18-33.



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Abstract

Due to environmental pollution and habitat depletion, the frog population is endangered. Frogs, of which some species live in the same environment with humans, need to be protected from human-caused negative effects. Therefore, this study aims to determine students' thoughts, emotions, and perceptions about frogs. The research design followed in this study is phenomenology design which belongs to the qualitative tradition. The study group was determined by the convenience sampling method which belongs to the purposive sampling technique. This study was conducted with a total of 77 students (43 females, 34 males) ranging between 10-11 years old. Participants are fifth-grade students at a secondary school in a town in the Marmara region of Turkey during the spring semester of the 2018-2019 academic year. The data were obtained through the Survey on Emotions and Thoughts prepared by the author. The results show that the majority of students think that frogs are important creatures but they do not have enough information about the reasons behind this. Moreover, it has been discovered that students have some knowledge about certain properties of frogs, however, they have misconceptions such as frogs breed by birth, have five lives, are mammals and poisonous, and that they infect warts when touched. The research results indicate that the majority of the students do not like frogs because of their slippery skin, nutrition with insects, googly eyes, and being disgusting. It has been observed that students mostly emphasize fish and kangaroo metaphors in their perception of frogs. In light of these results, live animals including frogs can be used in science classes, and students can get familiarized with them.

Keywords: Secondary school students, environmental pollution, metaphor, perception of frogs, misconceptions.

INTRODUCTION

Amphibians are among vertebrates whose population is rapidly decreasing (Hof et al., 2011). The majority of amphibians are frogs. Frogs are highly susceptible to environmental changes as they need both aquatic and terrestrial ecosystems to survive (Hamer & McDonnell, 2008; Hussain & Pandit, 2012). Frogs are also threatened by factors such as environmental destruction and environmental pollution (Blaustein et al., 2003; Deutsch, Grisolia, Bilanca, & Agostini 2021; Gascon, et al., 2007). Frogs are mostly used in food or traditional medicine sectors and are widely commodified (Gascon et al., 2007; Ríos-Orjuela, Falcón-Espitia, Arias-Escobar, Espejo-Urbe & Chamorro-Vargas, 2020; Xie et al., 2007). For this reason, frogs, whose population is dwindling and some species are at risk of extinction, have an important role in the functioning of ecosystems (Lindemann-Matthies & Bose, 2008; Prokop et al., 2016).

Some frogs share the same habitat with humans (Prokop et al., 2016). Therefore, frogs must be protected against human-based adverse effects (Tomažič & Šorgo, 2017). Therefore, individuals' emotions and thoughts regarding animals are also effective in developing protecting behaviors towards animals (Prokop et al., 2011; Vergara-Rios et al., 2021). Individuals' attitudes towards animals play an important role in the fate of certain species (Fonseca, Sá-Pinto, Dinis, & Vasconcelos, 2021; Moss, 2019). Because individuals' negative emotions, thoughts, and perceptions about frogs cause the formation of negative attitudes, behavior, and intolerance towards frogs (Prokop & Fančovičová, 2012; Tomažič, 2008). Individuals' improvement in knowledge, attitudes, and perceptions about frogs is regarded as necessary for the protection of these creatures (Prokop et al., 2008; Robina-Ramírez, Merodio, & McCallum, 2020).

It is argued that the relevant studies are not sufficient on students' knowledge, thoughts, attitudes, etc. about frogs. (Tomažič & Šorgo, 2017). In this limited number of studies, for example, a study conducted in Germany, it was stated that the knowledge of 9-11-year-old students was not sufficient about

amphibians and they could not identify the amphibian species (Randler et al., 2005). In another study conducted in Portugal, it was revealed that individuals exhibit negative behaviors towards frogs (Ceríaco, 2012). Studies conducted in Slovenia, Ethiopia, Colombia, Brazil, and the USA, indicate that individuals' attitudes towards frogs are negative (Jimenez & Lindemann-Matthies, 2015a; Kassie, 2020; Moss, 2019; Pontes-da-Silva et al., 2016; Tomažič, 2008), and it is stated that people believe they are poisonous and can spread warts when touched (Tomažič, 2008; Tomažič & Šorgo, 2017). It has also been asserted that individuals often perceive frogs as disgusting and tend to harm them (Tomažič & Šorgo, 2017). Other studies also show that frogs are perceived as slimy, disgusting, and unpleasant creatures (Davey, et al., 1998; Prokop & Fančovičová, 2012; Prokop et al., 2016; Randler et al. 2005). However, some studies indicate that Chinese people think frogs are beautiful, useful, important, and delicious, and it has been stated that they have a positive attitude towards frogs (Jimenez & Lindemann-Matthies, 2015b). It is argued in the literature that individuals' emotions and thoughts about frogs are rarely positive in research results, and the features of frogs mentioned by the individuals are generally negative.

Features such as the size, appearance, and their phylogenetic relationship with humans, (Borgi & Cirulli, 2015; Herzog, 2010; Knight et al., 2003) families' emotions, thoughts, and information about frogs (Brom, Anderson, Channing, & Underhill, 2020; Prokop et al., 2016), cultural beliefs and lack of knowledge (Brom et al., 2020; Pontes-da-Silva et al., 2016; Tarrant et al., 2016), morphological features and behaviors of the animals (Hillman, 1991), disgust from that animal (Prokop et al., 2016), harming nature and danger to humans (Curtis et al., 2004; Loe & Röskaft, 2004; Schlegel & Rupf, 2010), economic value are effective in shaping students' negative perceptions and attitudes towards animals or frogs (Pontes-da-Silva et al., 2016; Serpell, 2004; Ceríaco, 2012). Moreover, individuals were found to be afraid of getting harmed or infected by frogs, hence they dislike them (Prokop & Fančovičová, 2013; Prokop et al., 2016).

Individuals' emotions and thoughts towards animals during school age are effective in developing behaviors to protect them (Prokop et al., 2011). Teaching about the life of frogs in school and learning about them positively affect students' attitudes and knowledge towards them (Randler et al., 2005; Tomažič, 2011b). A study conducted in China shows that the more information students have about frogs, the more positive thoughts and protection behavior they exhibit as they think frogs are beautiful (Jimenez & Lindemann-Matthies, 2015a). Thus, students' knowledge of frogs is considered influential for the protection of frogs. However, it is also determined that students have misconceptions about frogs (Pontes-da-Silva et al., 2016). For example, animals are thought to be hostile towards people (Pontes-da-Silva et al., 2016), and it is also stated that frogs will infect warts when their slimy skin is touched or people think they are poisonous (Tomažič, 2011b). Students' misconceptions might potentially affect their emotions and thoughts towards frogs.

Students' perceptions, emotions, and thoughts about frogs are very significant (Prokop et al., 2011; Tomažič & Šorgo, 2017). Because young people who will become future adults will make decisions and act according to their knowledge, perception, emotions, and thoughts regarding frogs. In addition, the fact that students do not care, dislike or disgust a creature negatively affects learning the subjects that contain these creatures in biology courses (Dervişoğlu et al., 2009). Therefore, positive information, emotions, thoughts, and attitudes of the students towards frogs can be enhanced with the education to be given (Kellert, 1980; Moss, 2019). However, studies reveal that attitudes towards feared, disgusted and disliked animal species are quite difficult to convert from negative to positive (Kaltenborn et al., 2006). Additionally, Jimenez and Lindemann-Matthies (2015a) stated that people know little about amphibians, especially their knowledge of frogs is limited. Information, emotions, and thoughts of Turkish students for frogs are not available in the literature. This study is expected to contribute to the reconstruction of teaching subjects that shall be provided regarding frogs with the data obtained in this study results. Moreover, since the majority of studies in the literature on individuals' attitudes and knowledge towards frogs are carried out with a quantitative approach it is thought that this study which is based on the qualitative approach may provide significant findings to the literature.

The study aims to determine students' emotions, thoughts, and perceptions about frogs. For this purpose, answers to the following problems were sought: 1. What are the students' emotions and thoughts about frogs? 2. What are the students' knowledge levels, and ways of obtaining information about frogs? 3. What are the students' perceptions of frogs? 4. What are the misconceptions of secondary school students about frogs?

METHOD

This study follows 'phenomenology design' which is one of the qualitative research designs (Merriam, 2013). Phenomenology is applied in revealing experience, thought and perceptions, etc. related to the cases that a study group may encounter in daily life but not fully understand (Creswell et al., 2007; Yıldırım & Şimşek, 2016).

Study Group

The study group was determined by convenience sampling method which is one of the purposeful sampling types (Büyüköztürk et al., 2011). This sampling method was preferred because it is suitable in terms of time and cost (Merriam, 2013). This study was conducted with a total of 77 students (43 females, 34 males) who attended the fifth grade at a secondary school in a town center in the Marmara region of Turkey during the spring semester of the 2018-2019 academic year. Participants' ages vary between 10-11 years old and they voluntarily participated in the study.

Data Collection and Analysis

A survey titled "Survey on Emotions and Thoughts" was applied to determine students' emotions, thoughts, and perceptions about frogs (Appendix 1). Questions in the survey; I. Metaphor, II. Drawing and writing, III. 3 open-ended questions. The third question consists of four different sub-dimension questions. This questionnaire was applied one month later after the fifth-grade students were taught about frogs with World of Creatures/ Creatures and Life units in the course. The science teacher presented the subject to the students by using a slide show on frogs, had them watch some videos on the subject, and ran a question-and-answer session at the end of the lesson.

Data acquisition techniques applied in the survey are as follows:

Metaphor: A metaphor is used to determine students' perceptions of frogs (Guerrero & Villamil, 2002; Jensen, 2006). The Mental Metaphor Theory reveals that metaphors express the emotions, thoughts, and perceptions of individuals about a concept (Fredriksson & Pelger, 2016; Lakoff, 1993; Lakoff & Johnson, 1980). Thus, metaphors are used as a measure for perception determination (Arnett, 1999). Driven by the literature, students were asked to complete sentences such as 'Frogs are similar with /because' to determine their metaphors regarding frogs.

Drawing-Writing technique: Drawing and writing technique is applied in determining individuals' knowledge, misconceptions, thoughts, and beliefs (White & Gunstone, 1998). Studies that utilized the drawing-writing technique have been recently grasping more attention in the literature. This technique is also frequently used in studies in the field of biology education. Other studies apply this technique on subjects such as the human body (Bartoszeck et al., 2008; Pluhar et al., 2009), plants (Stagg & Verde, 2019; Villarroel et al., 2018), viruses (Hamdiyati et al., 2018), and health (Renslow & Maupinb, 2018). Students were asked both to draw and to explain their drawings briefly about frogs in the questions prepared with this technique.

Open-ended question technique: Open-ended questions were asked to reveal students' knowledge, emotions, and thoughts about frogs. Open-ended questions were included so that students could answer freely, authors can get unexpected answers, and have more detailed and elaborated information on the subject (Büyüköztürk et al., 2011).

The survey was prepared after the literature review phase. The pilot study of the survey questions was conducted with 10 students attending the fifth-grade science course. Questions that were not understood and did not serve the study's purpose were revised. Additionally, two science teachers, an academic in the field of biology education and a Turkish Language and Literature teacher were asked to examine the

questions in semantic terms and grammar during the preparation of the survey and for the final form. Any uncertain question was modified and the survey was finalized.

The data were analyzed according to content analysis methods. The purpose is to reach the themes that can explain the data, specify the relationships between them, and present the data to the scholars in an organized manner. During the content analysis, the data similar to each other are coded primarily, grouped, organized, and interpreted within the framework of certain themes (Yıldırım & Şimşek, 2006). The data were analyzed on a singular question basis. The data were repeatedly controlled by the researcher and brief notes were taken about coding before the analysis. Each different expression given by students for a question is coded separately in the data analysis. The expressions for each question are categorized by grouping them under certain themes and sub-themes. The coding was carried out separately by a researcher and a Ph.D. student experienced in content analysis, then compared to discuss the similarities and differences. Through a common decision, theme and sub-theme coding were finalized and tables were formed. The reliability of the coding was calculated according to the formula of $\text{Reliability} = \frac{\text{Consensus}}{(\text{Consensus} + \text{Disagreement})} \times 100$ based on the coding made by both coders (Miles & Huberman, 2015). According to this formula, intercoder reliability was calculated as 89%. This ratio was interpreted as adequately reliable for data analysis (Miles & Huberman, 2015). Besides, students' remarkable arguments are presented by addressing student numbers in the study (as (K₂₀)) with the apostrophe sign. The codes, themes, and sub-themes obtained after the analysis were reviewed by an academic studying biology education. All data tools, raw data, coding made during the analysis phase, and all necessary documents related to the subject in this study are reserved for expert review.

RESULTS

Findings obtained from the survey on emotions and thoughts about frogs are presented in this section.

1. Sources of thought, information, and knowledge for frogs

The findings of students' opinions about the importance of frogs are illustrated in Table 1.

Table 1. The distribution of students' thoughts on the importance of frogs and its reasons into categories.

Theme	Codes	f	Total f
Important	It is important for ecological balance. It's a part of the food chain.	27	52
	It has a duty like every other creature	10	
	It is a living being	9	
	Features (Amphibian, respiratory pattern, metamorphosis ability, vertebrate)	9	
	It is an endangered species	3	
	Some frog's poisons are beneficial	1	
	It embellishes the nature	1	
	It's rare	1	
	It is not harmful	1	
Not important	It has no function or contribution in nature	8	24
	It has no benefit to people	4	
	It is not liked	3	
	People cannot swim because they live in lakes	1	
	It's poisonous	1	
	It's a scary creature	1	
	It's rare in the nature	1	
	There are other creatures in nature	1	

Students' thoughts on the importance of frogs are categorized under two themes: 'Important (52) and not important (24)' in Table 1. In the theme of "important", the students expressed that "It is important for the ecological balance, it is a part of the food chain (27)", "It has a duty like every other creature" (10), "It is a living being (9) and Features (Amphibian, respiratory pattern, metamorphosis ability, vertebrate) (9)". In the category of "not important", students expressed their thoughts as "It has no function or contribution in nature" (8), "It has no benefit to people" (4), and "It is not liked" (3). Examples of these findings are as follows:

"Frogs are important creatures. Because they feed on mosquitoes." (K₄₄)

"Frogs are important because they are important for the food chain and do not harm people." (K₁₂).

"Frogs are not important. Because I don't like them, they are poisonous." (K₃₁)

"Frogs are not important. Because it has no contribution to people." (K₁₀)

The findings on the students' drawings about frogs are presented in Table 2.

Table 2. The distribution of the findings on students' drawings related to frogs into categories.

Theme	Sub-theme	Drawing codes	f	Total f
Features	Skin structure	Similarity to soap	2	6
		Slippery and moist skin	1	
		Snake resemblance from the skin	1	
		Similarity to sponge	1	
		Green color of frogs	1	
	Jumping	Bouncing frogs	6	10
		Metaphor to kangaroo and rabbit	2	
		Bouncing crickets	1	
		Frogs similarity to balloons	1	
	Metamorphosis	Frogs' ability for metamorphosis	6	14
		Amphibian Nature	4	
		Frogs' similarity to fish	2	
		Frog larvae's resemblance to fish	1	
		Ability to evolve	1	
	Living environment	Frog hunting a fly with its long tongue	23	48
		Frogs sunbathing on stones and leaves	11	
		Natural habitats of frogs in water and on land	9	
		Frogs in our pool	3	
		Forest habitat	1	
		Turtle metaphor (living on land and in water)	1	
Emotions	Positive	People's love towards and friendship with frogs	7	13
		They are sweet creatures	4	
		Fear of unintentional harm	1	
		Protective superhero	1	
	Negative	Not sympathizing and dislike	5	11
		Disgust and loath (skin, eyes, etc.)	5	
Misconception		They are dirty creatures	1	7
		Butterfly resemblance (amphibian living style)	3	
		Frogs taking care of their offspring	2	
		Tough shells of frogs	2	

As illustrated in Table 2, students' drawings for frogs are categorized under 3 themes, being "feature, emotion, and misconception". Students expressed "Similarity to soap" (2) in the sub-theme of "Skin structure (6)" under the theme of the "Feature" category, "Jumping Frog" (6) in the sub-theme of "Jumping (10)", "metamorphosis" (6) and "amphibian nature" (4) in the sub-theme of "Metamorphosis (14)", "frogs hunting flies with a long tongue and sunbathing on stones and leaves" (11) in the sub-theme of "living environment (49)". Under the "Emotion" theme, students mentioned, "People's love towards frogs and friendship with frogs" (7) in the "positive (13)" sub-theme while expressing "Not sympathizing and dislike" (5) and "Disgust and loath (skin, eyes, etc.)" (5) under the "Negative (11)" sub-theme. Moreover, misconceptions were determined in ideas that there is a "butterfly resemblance (amphibian nature)" (3), "frogs taking care of their offspring" (2), and "frogs' hard shells" (2). Examples of these findings are presented in Appendix 2. Findings related to students' information on frogs and the information sources are presented in Table 3.

Table 3. Distribution of the findings on students' information on frogs and the information sources by categories.

Theme	Codes	f	f	Information Source	f
Yes	Amphibian Nature	36	60		
	Vertebrate nature	23			
	Metamorphosis	21			
	Breeding by eggs	14			
	Moist and slippery skin	10		Science teacher	60
	Living in both water and land	9		Family	15
	Nutrition with insects and flies	8		Documentaries	2
	Breathing both through lung and skin	8		Cousins	1
	Some are poisonous	5		Science books	1
	Jumping	4			
	Not caring for offspring	3			
	Long tongues	2			
	Resting on the leaves in the water	2			
	Tadpole shape in larvae phase	1			
No	I am afraid of them	1	10	Nobody told me.	6
	Not specified	9			
Misconception	Breeding by birth	3	7		
	Mammal	2			
	Adopting to five separate environments	1			
	Infesting warts when touched	1			

As illustrated in Table 3, students' knowledge of frogs is divided into 3 categories as "Yes (60), No (10), and Misconception (6)". In the "Yes" category, it was determined that students mostly had knowledge of "amphibian nature" (36), "vertebrate nature" (23), and "Metamorphosis" (21). Besides, it was stated that some of the students did not know about frogs (10). The information source was determined to be mostly science teachers (60) and families (15). In addition, several misconceptions (7) were observed in student statements. Student misconceptions regarding frogs such as "breeding by giving birth" (3), "being a mammal" (2), "adopting to five-living environments" (1), and "infesting warts when touched" (1) were observed. Examples of these findings are as follows:

"I learned these from my teacher and my family. Frogs are amphibians creatures; their bodies are moist." (K₉)

"I learned this from our teacher. Frogs are vertebrate animals, adult frogs inhale through skin and lungs." (K₄₁)

"As I learned from my teacher, frogs are amphibians, they breed by birth, metamorphose, and some are poisonous." (K₃₆)

2. State of emotions for frogs

Findings on the state of students' emotions towards frogs are demonstrated in Table 4.

As shown in Table 4, the emotion types of students about frogs are divided into three categories as "I sympathize (22), I Don't Like (55) and Misconception (10)". Students mentioned "Jumping" (4), "Interesting and beautiful sounds" (2), and "Slimy and soft skin" (2) under the "I sympathize" theme of frogs within the "physical properties" sub-theme. In the "Thought" sub-theme, the students mentioned, "Sweet and cute creatures" (7) and "Love for animals" (4) while. "Playing with them as a kid" (1) and "having some in the garden" (1) seem to be effective in sympathizing with them under the "Interaction" sub-theme.

Table 4. Distribution of the findings on the state of students' emotions towards frogs into categories

Theme	Sub-theme	Codes	f	Total f
I sympathize with them.	Physical features	Jumping	4	22
		Interesting and beautiful sounds	2	
		Slimy and soft skin	2	
		Non-toxic nature	1	
		Long tongues	1	
	Thought	Sweet and pretty creatures	7	
		Animal love	4	
		Benefit to nature	2	
		Water reminding nature	1	
		Harmless nature	1	
	Interaction	Playing with them as a kid	1	
		Having some in the garden	1	
	Feature	Their skin is runny, moist, and slippery.	12	
		Nutrition with insects	5	
		Having googly eyes	2	
		Ugly appearance	2	
		Jumping	2	
		Annoying sounds	2	
I don't like it.	Thoughts and emotions			54
		Disgusting and loathing nature	17	
		Scary nature	10	
		Disgusting nature	8	
		Strange nature	1	
		No encounter	1	
		Dislike	1	
	Misconception	Poisonous nature	5	
		Having hard shells	1	
		Not benefit to nature	1	
		Leaving paint on our hands	1	
		Being non-essential creatures	1	
		Rare encounters	1	

The reasons for students not to like frogs in the “Feature” sub-theme under the “I don't sympathize” category are the “Runny, moist and slippery skin” (12) and “Nutrition with insects” (5), while under “emotions and thoughts” sub-theme it was determined that they did not like them because of frogs' "Disgusting and loathing nature (17) and “scary nature (10)". Besides, students' misconceptions such as “poisonous nature” (5), “having hard shells” (1), “no benefit to nature” (1), “leaving paint on our hands” (1), “being non-essential creatures” (1) were identified. Examples of these findings are as follows:

"I don't sympathize with frogs because I am disgusted and scared from them." (K₁₁)

"I like frogs and I like to follow them while they are jumping." (K₉)

"I don't like frogs because some of their species are poisonous." (K₅₁)

"I love frogs and animals." (K₃₈)

3. Perception of frogs

Findings regarding students' perceptions of frogs are detailed in Table 5.

Table 5. The distribution of the findings on students' metaphoric perceptions of frogs into categories.

Rank Number	Metaphor	f	Rank Number	Metaphor	f
1	Fish	18	17	Fly	1
2	Kangaroo	6	18	A dirty animal	1
3	Crocodile	6	19	Reptile	1
4	Cricket	4	20	Caterpillar	1
5	Soap	3	21	Flower	1
6	Bounce ball	3	22	Sweet a little	1
7	Butterfly	3	23	Life	1
8	Bunny	2	24	Animal	1
9	Monster	2	25	Balloon	1
10	Human	2	26	Bad	1
11	Turtle	2	27	Water	1
12	Flower	2	28	A swimming creature	1
13	Snake	2	29	Mud	1
14	Jumping creature	2	30	Sponge	1
15	Bugs	2	31	Runny creature	1
16	Lake	1	32	Green paint	1
TOTAL					77

Table 5 indicates that the students used a total of 77 frog metaphors of which 32 are unique. In these metaphors, students mostly emphasized fish (18), kangaroo (6), crocodile (6), and cricket (4) metaphors. Examples of these findings are as follows:

Frogs look like soap. Because they are very slippery. (K₄₅)

Frogs look like crickets. Because they jump. (K₅₄)

Frogs look like monsters. Because its eyes are so big. (K₃₇)

Frogs look like snakes. Because both are disgusting and frightening. (K₇₀)

Frogs look like fish. Because frogs live in water when they are babies. (K₂₆)

The distribution of the findings on students' perceptions of frogs into categories is presented in Table 6.

Table 6. The distribution of students' metaphors towards frogs into categories.

Theme	Sub-theme	Codes	f	Total
Feature	Living environment	Mud	1	3
		Lake	1	
		Water	1	
	Jumping	Kangaroo	6	17
		Cricket	4	
		Bounce ball	3	
		Bunny	2	
		Very bouncy	1	
		Jumping creature	1	
	Similarity	Fish	11	30
		Crocodile	6	
		Turtle	2	
		Human	2	
		Monster	2	
		Animal	1	
		Wood	1	
		Fly	1	
		Reptile	1	
		Insect	1	
		Balloon	1	
		A swimming creature	1	

Emotion	Skin structure	Soap	3	6
		Sponge	1	
		Runny creature	1	
		Green paint	1	
	Metamorphism	Fish	7	12
		Butterfly	3	
		Caterpillar	1	
		Flower	1	
	Positive Emotion	Flower	2	4
		Sweet a little	1	
		Life	1	
	Negative Emotion	Snake	2	5
		A dirty animal	1	
		Bugs	1	
		Bad	1	
Total		77	77	

As illustrated in Table 6, the metaphors students used for frogs are categorized into two themes, as “Feature and Emotion”. In the “jumping (17)” sub-theme, the students mostly refer to the metaphors of “Kangaroo” (6), “Cricket” (4) and “Bouncy ball” (3), and mostly “Fish” (11), “Alligator” (6) and “Turtle” (2) in the “Similarity (29)” sub-theme. For the sub-theme of “Metamorphism (12)”, they mentioned mostly “Fish” (7) and “Butterfly” (3) metaphors. The metaphors used in the “Positive Emotion” (4) sub-theme under the “Emotion” theme are the “Flower” (2) and “Sweet a little” (1). The metaphors used in the “Negative Emotion (5)” sub-theme are “Snake” (2), “A dirty animal” (1), and “Bad” (1).

DISCUSSION AND CONCLUSION

This study aims to determine students' emotions, thoughts, and perceptions about frogs. The research results show that the majority of students thought that frogs were important animals. These results are in line with Jimenez and Lindemann-Matthies's study (2015b), which determined that Chinese individuals consider frogs important. Moreover, students emphasized the nutrition of frogs with insects in their knowledge and drawings. With these results, it can be asserted that students think that frogs are important creatures in terms of ecological balance and food chain. These results were found positive in terms of students' disposition towards frogs. Because there is a positive correlation between the students' awareness of the importance of frogs and their tolerance towards them (Jimenez & Lindemann-Matthies, 2015b; Prokop & Fančovičová, 2012). Thus, when students think that frogs are important creatures, they have higher tolerance towards frogs living in their environment.

Other findings on the reasons why frogs are important creatures indicate some students think that frogs have a function in the ecosystem like any creature. This result may reveal that some students think that frogs are important, but they do not have enough information about its reasons. Moreover, several students stated that frogs are not important creatures, they don't have a function in nature and a benefit to humanity. These results predict that some students do not have sufficient information regarding the importance of frogs and its reasons in a holistic manner. The results that individuals do not have enough information about frogs are in line with other studies in the literature (Jimenez & Lindemann-Matthies, 2015a; Randler et al., 2005). This shows that students have difficulties in understanding the importance of frogs and therefore an elaboration in education is needed (Jimenez & Lindemann-Matthies, 2015a; Prokop & Fančovičová, 2012). This situation is worrisome for the protection of frogs, whose population is in a rapid decline, and some species are at risk of extinction. Considering these results, more emphasis can be put on the importance and function of frogs for the ecosystem, and their benefits to humanity as well as other creatures, in teaching students the subject of frogs in the science course.

The research revealed that the majority of students have certain information about frogs. The majority of students stated that they have information about frogs as they are vertebrate animals, amphibians, breed by eggs, have metamorphosis and moist and slippery skin. Besides, it was observed that students

mostly emphasized the skin structure, metamorphism, and living environments in their drawings for frogs. This indicates that students have information about the properties of frogs. This result contradicts the results of a previous research in the literature arguing that German students do not have sufficient knowledge about amphibians (Randler et al., 2005). The fact that fifth-grade students in Turkey who are included in the study have certain knowledge about frogs, may be caused by the short period of time between the research and the time that the science teachers have taught them about frogs in the class. It is important that students have information about frogs. Because it has been determined that there is a positive correlation between students' knowledge about frog features and their attitudes towards them. The more students know about frogs, the more they perceive them as beautiful and exhibit protective behavior (Jimenez & Lindemann-Matthies, 2015b; Prokop et al., 2008). In addition, it was stated that the majority of students obtained their knowledge about frogs from science teachers. This situation has been interpreted as a positive factor. Because the literature points that the main source of information for students about frogs is family (Pontes-da-Silva et al., 2016) or social environments and this information may be false (Fagundes, 2001). Thus, students' correct information about frogs learned from science teachers was interpreted positively regarding students' knowledge, attitude, and behavior towards them.

The research also revealed that students also have misconceptions about frogs. Findings on the students about the information and emotions about frogs indicated to misconceptions such as frogs breed by birth, infect warts or leave paint when touched, are mammals, poisonous, not beneficial to nature and have five-living environments, hard shells. Moreover, misconceptions such as frogs are similar to butterflies, they care for their offspring, and have hard shells were observed in the drawings of frogs. These findings are in line with the study which argued that Chinese students have misconceptions about frogs (Pontes-da-Silva et al., 2016). The findings are also similar to the misconceptions such as frogs infect warts and poison when their slimy skin is touched (Tomažič, 2011b). A significant proportion of students in Turkey also thinks that frogs are poisonous animals. In addition, the findings regarding the importance of frogs and the reasons why they do not like frogs indicate that the idea that frogs are poisonous is a particular factor. However, there are no poisonous frog species detected as of now in Turkey (Mature, 2018). Thus, these results are considered noteworthy. It is thought that the reason for these results may stem from the information obtained from the family and social environment. As it is stated that students' misconceptions and misinformation about frogs may be caused by family and social environment (Fagundes, 2001; Pontes-da-Silva et al., 2016). Therefore, students' misconceptions on frogs and whether frogs are poisonous or not may be elaborated in science classes while teaching relevant sections. Students' knowledge will be increased, their emotions and thoughts will be positively developed through this method.

The research results show that the majority of students do not sympathize with frogs. The reasons why students don't like frogs include frogs' runny, moist and slippery skins, their nutrition on insects, googly eyes, and appearance. Besides, students' emotions that frogs are frightening, disgusting, and loathing animals are among the reasons why they don't like them. Moreover, it was determined that students highlighted metaphors such as snakes, dirty animals, monsters, and bad in their metaphorical perceptions about frogs. The findings of not sympathizing, dislike, disgust, and loath from frogs were observed. Piecing these results together, it can be argued that students' emotions towards frogs are mostly negative. These results coincide with researches conducted in Slovenia, Brazil, Colombia, and the USA indicating that individuals' attitudes towards frogs are negative (Jimenez & Lindemann-Matthies, 2015a; Moss, 2019; Pontes-da-Silva et al., 2016; Tomažič, 2008), frogs are generally perceived as disgusting by humans (Tomažič & Šorgo, 2017), and perceived by people as slimy-bodied, disgusting and unpleasant creatures (Davey et al., 1998; Prokop & Fančovičová 2012; Prokop et al., 2016; Randler et al., 2005). These conditions are caused by frogs' appearance (Borgi & Cirulli, 2015; Herzog, 2010; Knight et al., 2003), cultural beliefs (Pontes-da-Silva et al., 2016; Tarrant et al., 2016), frogs' morphological features (Hillman, 1991) and disgust from frogs (Prokop, et al., 2016). It has also been determined that individuals fear and disgust potential damage by frogs and associate them with factors such as disease (Prokop & Fančovičová, 2013; Prokop et al., 2016). However, another study indicates that Chinese individuals have a positive attitude towards frogs (Jimenez & Lindemann-Matthies, 2015b).

Individuals' emotions and thoughts towards frogs being generally negative is a widely accepted argument. Thus, the emotional orientation of students towards animals is considered important in developing behaviors towards animals and their protection (Prokop et al., 2011). Also, individuals' attitudes towards animals play an important role in the fate of a species (Moss, 2019). Besides, disgust towards frogs increases people's intolerance to frogs, reduces their desire to protect and push frogs out from their environment (Jacobs et al., 2014; Prokop & Fančovičová, 2012; Prokop & Fančovičová, 2013; Prokop et al., 2016). Students' lack of sympathy, as well as their disgust or dislike of a creature negatively affects their learning about the subjects that contain these creatures in biology courses (Dervişoğlu et al., 2009). After all, students' emotions and thoughts about frogs may affect them negatively in decisions they will make in the future, behavior development, and science learning towards these creatures. These negative emotions and thoughts need to be transformed in a positive direction. Hence, more emphasis should be placed on the subject of frogs in science courses. The habitats of frogs, wetlands, and zoos can be visited through nature trips and students can get to know frogs more closely. The research results reveal that some students sympathized with frogs because of their jumping ability, interesting and beautiful sounds, sweet and cute looks, playing with them as a child, and having some in the garden. Students' drawings about frogs revealed that the students found frogs cute and that they thought frogs were good friends, as well. Considering these results, jumping movements, sounds, and interacting with them can have positive effects on students' learning about frogs. It is stated that students' direct contact or experience with live animals in the lessons where frogs are taught will improve their attitudes and knowledge (Fazio & Zanna, 1981; Yore & Boyer, 1997). Besides, teaching with live animals can reduce disgust against them, increase awareness, willingness to learn and attendance (Killerman, 1998; Tomažič, 2008; Tomažič & Šorgo, 2017). Live animals can be used in science classes including frogs and students can get familiarized with them.

The research results showed that students mostly emphasize fish metaphor in their perceptions of frogs and they are mostly compared to fish. It was determined that the reason behind this result was that frogs were similar to fish during the larva state, they also live in aquatic ecosystems when fully grown and their skin was slippery. It was also observed that students compared frogs to crocodiles and turtles. Besides, it was determined that students emphasized metaphors mostly about their similarities to other creatures in frog perceptions. These results show that frogs are compared to other creatures with their habitat and appearance. Thus, the similarities and differences of frogs and animals such as fish, crocodiles, and turtles should be highlighted in the subject of frogs in science classes. Misconceptions and misperceptions that may occur can be prevented in this way.

Research results revealed that students emphasized metaphors about jumping, skin structure, and metamorphosis in their perceptions of frogs. Students' drawings about frogs focused on frogs' slippery and moist skin structure, long tongues, jumping movements, and metamorphism. It can be argued that students pay more attention to their features such as long tongues, jumping, and metamorphosis, which are different and interesting from other creatures. Therefore, students' interests and curiosities can be further improved by highlighting the features of frogs in the science course. In addition, it can be useful to bring a live sample to the class on frogs and enable students to experience these mentioned features. The disgust and negative emotions of students towards frogs can be reduced. Moreover, it was observed that students' drawings emphasized hunting with the long tongue, frog's environment, and conditions. This result suggests that students perceive frogs mostly in their natural habitats. In light of these results, visiting frogs' natural habitats such as pools and gardens may benefit students' positive emotions and thought development. Because students' direct experience with frogs has been asserted to increase their positive attitude towards these creatures (Ballouard et al., 2013; Tomažič, 2008; Tomažič & Šorgo, 2017).

Within the scope of the research, the following recommendations can be made for educators and researchers. Live animals can be used in the classroom while teaching the subject of frogs. Students can be provided opportunities to interact with frogs, get to know them better, and create a life. Students can visit places such as lakes and puddles from the habitats of frogs. Teachers can emphasize more the known misconceptions about frogs. Teachers can use different methods and techniques in teaching the topic of frogs, and the activities can be improved by including visuals such as documentaries, pictures,

and videos about frogs. Students' knowledge, attitudes, and perceptions about frogs can be improved, their tolerance for frogs may increase, protective behaviors may occur and potential misconceptions may be prevented. Scholars can study with larger samples using different quantitative and qualitative data collection tools on different grade levels to determine students' knowledge, emotions, thoughts, perceptions, and attitudes towards frogs. Factors affecting these variables can be explored in detail. The impact of using frogs and other creatures in science education classes on students' learning, emotions, thoughts, and perceptions can be investigated.

Ethics and Conflict of Interest

The author declares that the study has not unethical issues and that research and publication ethics have been considered carefully.

REFERENCES

- Arnett, R.C. (1999). Metaphorical guidance: administration as building and renovation. *Journal of Educational Administration*, 37(1), 80-89. doi: [10.1108/09578239910253953](https://doi.org/10.1108/09578239910253953)
- Ballouard, J. M. et al. (2013). School children and one of the most unpopular animals: Are they ready to protect snakes? *Anthrozoös*, 26(1), 93-109. doi: [10.2752/175303713X13534238631560](https://doi.org/10.2752/175303713X13534238631560)
- Bartoszeck, A. B., Machado, D. Z., & Amann-Gainotti, M. (2008). Representations of internal body image: A study of pre-adolescents and adolescent students in Araucaria, Paraná, Brazil. *Ciências & Cognição*, 13(2), 139-159.
- Blaustein, A. R., Romansic, J. M., Kiesecker, J. M., & Hatch, A. C. (2003). Ultraviolet radiation, toxic chemicals and amphibian population declines. *Diversity and Distributions*, 9(2), 123–140. doi: [10.1046/j.1472-4642.2003.00015.x](https://doi.org/10.1046/j.1472-4642.2003.00015.x)
- Borgi, M., & Cirulli, F. (2015). Attitudes toward animals among kindergarten children: Species preferences. *Anthrozoös*, 28(1), 45-59. doi: [10.2752/089279315x14129350721939](https://doi.org/10.2752/089279315x14129350721939)
- Brom, P., Anderson, P., Channing, A., & Underhill, L. G. (2020). The role of cultural norms in shaping attitudes towards amphibians in Cape Town, South Africa. *PloS one*, 15(2). doi: [10.1371/journal.pone.0219331](https://doi.org/10.1371/journal.pone.0219331)
- Büyüköztürk, Ş., Kılıç Çakmak, E., Akgün, Ö. E., Karadeniz, Ş., & Demirel, F. (2011). *Scientific research methodology*. Ankara: Pegem Academy.
- Ceríaco, L. M. P. (2012). Human attitudes towards herpetofauna: The influence of folklore and negative values on the conservation of amphibians and reptiles in Portugal. *Journal of Ethnobiology and Ethnomedicine*, 8(1), 8. doi: [10.1186/1746-4269-8-8](https://doi.org/10.1186/1746-4269-8-8)
- Creswell, J. W., Hanson, W. E., Clark Plano, V. L., & Morales, A. (2007). Qualitative research designs: Selection and implementation. *The Counseling Psychologist*, 35(2), 236-264. doi: [10.1177/0011000006287390](https://doi.org/10.1177/0011000006287390)
- Curtis, V., Auger, R., & Rabie, T. (2004). Evidence that disgust evolved to protect from risk of disease. *Proceedings of the Royal Society B: Biological Sciences*, 271, 131-133. doi: [10.1098/rsbl.2003.0144](https://doi.org/10.1098/rsbl.2003.0144)
- Davey, G. C. L., et al. (1998). A cross-cultural study of animal fears. *Behaviour Research and Therapy*, 36(7-8), 735-750. doi: [10.1016/s0005-7967\(98\)00059-x](https://doi.org/10.1016/s0005-7967(98)00059-x)
- De Guerrero, M. C., & Villamil, O. S. (2002). Metaphorical conceptualizations of ESL teaching and learning. *Language Teaching Research*, 6(2), 95-120. doi: [10.1191/1362168802lr101oa](https://doi.org/10.1191/1362168802lr101oa)
- Deutsch, C., Grisolia, J., Bilenca, D., & Agostini, M. G. (2021). Human attitudes as threats in amphibians: the case of the Ornate Horned Frog (*Ceratophrys ornata*). *Human Dimensions of Wildlife*, 26(3), 210-227. doi: [10.1080/10871209.2020.1808122](https://doi.org/10.1080/10871209.2020.1808122)
- Dervişoğlu, S., Menzel, S., Soran, H., & Boegeholz, S. (2009). Influence of values, beliefs and problem perception on personal norms for biodiversity protection. *Hacettepe University Journal of Education*, (37), 50-59.
- Fagundes, M. B. (2001). *Aprendendo valores éticos*. Belo Horizonte: Editora Autêntica.
- Fazio R. H., & M. P. Zanna (1981). *Direct experience and attitude-behavior consistency*. Advances in experimental social psychology, San Diego: Academic Press.
- Fonseca, C. A., Sá-Pinto, X., Dinis, H. A., & Vasconcelos, R. (2021). Shooting skinks for good: Producing a movie improves attitudes towards a threatened species. *Science of The Total Environment*, 1-9. doi: [10.1016/j.scitotenv.2021.148356](https://doi.org/10.1016/j.scitotenv.2021.148356)
- Fredriksson, A., & Pelger, S. (2016). Metaphorical concepts in molecular biology students' texts—a way to improve subject-matter understanding. *Nordic Studies in Science Education*, 12(1), 90-106. doi: doi.org/10.5617/nordina.1593

- Gascon, C., Collins, J. P., Moore, R. D., Church, D. R., McKay, J. E., & Mendelson, J. R. (Eds.). (2007). *Amphibian conservation action plan*. Gland, Switzerland, and Cambridge, United Kingdom: IUCN/SSC Amphibian Specialist Group.
- Hamdiyati, Y., Sudargo, F., Fitriani, A., & Rachmatullah, A. (2018). Changes in prospective biology teachers' mental model of virus through drawing-writing Test: An Application of mental model-based microbiology course. *Jurnal Pendidikan IPA Indonesia*, 7(3), 302-311. doi: [10.15294/jpii.v7i3.14280](https://doi.org/10.15294/jpii.v7i3.14280).
- Hamer, A. J., & McDonnell, M. J. (2008). Amphibian ecology and conservation in the urbanising world: a review. *Biological conservation*, 141(10), 2432-2449. doi: [10.1016/j.biocon.2008.07.020](https://doi.org/10.1016/j.biocon.2008.07.020).
- Herzog, H. (2010). *Some we love, some we hate, some we eat*. New York: Harper Collins.
- Hillman, J. (1991). *Going bugs*. New York: Spring Audio. Gracie Station.
- Hof, C., Araújo, M. B., Jetz, W., & Rahbek, C. (2011). Additive threats from pathogens, climate and land-use change for global amphibian diversity. *Nature*, 480, 516-519. doi: [10.1038/nature10650](https://doi.org/10.1038/nature10650).
- Hussain, Q. A., & Pandit, A. K. (2012). Global amphibian declines: A review. *International Journal of Biodiversity and Conservation*. 4(10), 348–357. doi: [10.5897/IJBC12.008](https://doi.org/10.5897/IJBC12.008)
- Jacobs, M. H., Vaske, J. J., Dubois, S., & Fehres, P. (2014). More than fear: Role of emotions in acceptability of lethal control of wolves. *European Journal of Wildlife Research*, 60(4), 589-598. doi: [10.1007/s10344-014-0823-2](https://doi.org/10.1007/s10344-014-0823-2).
- Jensen, F. N. (2006). Metaphors as a bridge to understanding educational and social contexts. *International Journal of Qualitative Methods*, 5(1), 1-17. doi: [10.1177/160940690600500104](https://doi.org/10.1177/160940690600500104).
- Jimenez, J. N., & Lindemann-Matthies, P. (2015a). Public knowledge of, and attitudes to, frogs in colombia. *Anthrozoös*, 28(2), 319-332. doi: [10.2752/089279315x14219211661976](https://doi.org/10.2752/089279315x14219211661976).
- Jimenez, J. N., & Lindemann-Matthies, P. (2015b). Public knowledge and perception of toads and frogs in three areas of subtropical southeast China. *Society & Animals*, 23(2), 166-192. doi: [10.1163/15685306-12341368](https://doi.org/10.1163/15685306-12341368).
- Kadijevic, G. M. (2017). Mental representations of preschool children about different animals. *Journal of Baltic Science Education*, 16(4), 500-509. ISSN 2538–7138.
- Kaltenborn, B. T., Bjerke, T., Nyahongo, J. W., & Williams, D. R. (2006). Animal preferences and acceptability of wildlife management actions around Serengeti National Park, Tanzania. *Biodiversity and Conservation*, 15, 4633-4649. doi: [10.1007/s10531-005-6196-9](https://doi.org/10.1007/s10531-005-6196-9).
- Kassie, A. (2020). Attitude, beliefs and perception of people towards amphibian conservation around chefa wetland, Oromo zone, Amhara National Regional State. *International Journal of Zoology Studies*, 29(5), 1-4.
- Kellert, S.R. (1980). American attitudes toward and knowledge of animals: An update. *International Journal for the Study of Animal Problems* 1(2), 87–119.
- Killermann, W. (1998). Research into biology teaching methods. *Journal of Biological Education*, 33(1), 4-9. doi: [10.1080/00219266.1998.9655628](https://doi.org/10.1080/00219266.1998.9655628).
- Knight, S., Nunkoosing, K., Wrij, A., & Cherryman, J. (2003). Using grounded theory to examine people's attitudes toward how animals are used. *Society and Animals*, 11(4), 307-327. doi: [10.1163/156853003322796064](https://doi.org/10.1163/156853003322796064).
- Lakoff, G. (1993). *The contemporary theory of metaphor*. (Ed. A. Ortony), Metaphor and thought (2nd ed.), Cambridge: Cambridge Univ. Press.
- Lakoff, G., & Johnson, M. (2008). *Metaphors we live by*. Chicago: The University of Chicago Press.
- Lindemann-Matthies, P., & Bose, E. (2008). How many species are there? Public understanding and awareness of biodiversity in Switzerland. *Human Ecology*, 38, 731-742. doi: [10.1007/s10745-008-9194-1](https://doi.org/10.1007/s10745-008-9194-1).
- Löe J., & Röskaf E. (2004). Large carnivores and human safety: A review. *Ambio*, 33 (6), 283-288. doi: [10.1579/0044-7447-33.6.283](https://doi.org/10.1579/0044-7447-33.6.283).
- Merriam, S. B. (2013). *Qualitative research: A guide to design and implementation*. 5th Edition, (Tran. Edit. S. Turan), Ankara: Nobel Academy Publishing.
- Miles, M. B., & Huberman, A. M. (2015). *An expanded resource book: Qualitative data analysis* (Trans. Ed. S. Akbaba Altun and A. Ersoy), Ankara: Pegem Academy.
- Moss, J. (2019). *An investigation of seventh grade students' attitudes towards animals in a middle school science classroom in rural Alabama*. Doctor Thesis, Department of Education, Auburn University.

- Olgun, K. (2018). *Is there a poisonous frog species in Turkey?* (Online, 22.10.2019), <http://www.kozmikturk.com/bilim/turkiye-de-zehirli-bir-kurbaga-turu-var-mi--6397>.
- Pluhar, Z. F., Piko, B. F., Kovacs, S., & Uzzoli, A. (2009). Air pollution is bad for my health: Hungarian children's knowledge of the role of environment in health and disease. *Health & Place*, 15(1), 239-246. doi:10.1016/j.healthplace.2008.05.005.
- Pontes-da-Silva, E., Pacheco, M. L. T., Pequeno, P. A. C. L., Franklin, E., & Kaefer, I. L. (2016). Attitudes towards scorpions and frogs: A survey among teachers and students from schools in the vicinity of an Amazonian protected area. *Journal of Ethnobiology*, 36(2), 395-412. doi: 10.2993/0278-0771-36.2.395.
- Prokop, P., Kubiakto, M., & Fančovičová, J. (2008). Slovakian pupils' knowledge of and attitudes toward birds. *Anthozoos*, 21(3), 221-235. doi: 10.2752/175303708X332035.
- Prokop, P., Uşak, M., Erdoğan, M., Fancovicova, J., & Bahar, M. (2011). Slovakian and Turkish students' fear, disgust and perceived danger of invertebrates. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, 40(40), 344-352.
- Prokop, P., & Fančovičová, J. (2013). Does colour matter? The influence of animal warning coloration on human emotions and willingness to protect them. *Animal Conservation*, 16(4), 458-466.
- Prokop, P., Medina-Jerez, W., Coleman, J., Fančovičová, J., Özel, M., & Fedor, P. (2016). Tolerance of frogs among high school students: influences of disgust and culture. *EURASIA Journal of Mathematics, Science and Technology Education*, 12(6), 1499-1505. doi: 10.12973/eurasia.2016.1241a.
- Randler, C., Ilg, A., & Kern, J. (2005). Cognitive and emotional evaluation of an amphibian conservation program for elementary school students. *The Journal of Environmental Education*, 37, 43-52. doi: 10.3200/JOEE.37.1.43-52.
- Renslow, J., & Maupin, J. (2018). Draw-and-write technique elicits children's perceptions of health in the USA and Guatemala. *Health Education Journal*, 77(1), 15-29. doi: 10.1177/0017896917735569.
- Ríos-Orjuela, J. C., Falcón-Espitia, N., Arias-Escobar, A., Espejo-Urbe, M. J., & Chamorro-Vargas, C. T. (2020). Knowledge and interactions of the local community with the herpetofauna in the forest reserve of Quininí (Tibacuy-Cundinamarca, Colombia). *Journal of Ethnobiology and Ethnomedicine*, 16(1), 1-11. doi: 10.1186/s13002-020-00370-8.
- Robina-Ramírez, R., Merodio, J.A.M., McCallum, S. (2020). What role do emotions play in transforming students' environmental behaviour at school? *Journal of Cleaner Production*, 258, doi: 10.1016/j.jclepro.2020.120638.
- Serpell, J. A. (2004). Factors influencing human attitudes to animals and their welfare. *Animal Welfare*, 13, 145-151.
- Stagg, B. C., & Verde, M. F. (2019). A comparison of descriptive writing and drawing of plants for the development of adult novices' botanical knowledge. *Journal of Biological Education*, 53(1), 63-78. doi: 10.1080/00219266.2017.1420683.
- Schlegel, J., & Rupf, R. (2010). Attitudes towards potential animal flagship species in nature conservation: A survey among students of different educational institutions. *Journal for Nature Conservation*, 18, 278-290. doi: 10.1016/j.jnc.2009.12.002.
- Tarrant, J., Kruger, D., & Du Preez, L. H. (2016). Do public attitudes affect conservation effort? Using a questionnaire-based survey to assess perceptions, beliefs and superstitions associated with frogs in South Africa. *African Zoology*, 51(1), 13-20. doi:10.1080/15627020.2015.1122554.
- Tomažič, I. (2008). The influence of direct experience on students' attitudes to, and knowledge about amphibians. *Acta Biologica Slovenica*, 51(1), 39-49.
- Tomažič, I. (2011a). Reported experiences enhance favourable attitudes toward toads. *Eurasia Journal of Mathematics, Science & Technology Education* 7, 253-262. doi: 10.12973/ejmste/75207.
- Tomažič, I. (2011b). Seventh graders' direct experience with, and feelings toward, amphibians and some other nonhuman animals. *Society & Animals*, 19, 225-247. doi: 10.1163/156853011X578901.
- Tomažič, I., & Šorgo, A. (2017). Factors affecting students' attitudes toward toads. *Eurasia Journal of Mathematics, Science and Technology Education*, 13(6), 2505-2528. doi: 10.12973/eurasia.2017.01237a.
- Vergara-Ríos, D., Montes-Correa, A. C., Urbina-Cardona, J. N., De Luque-Villa, M., Cattán, P. E., & Granda, H. D. (2021). Local community knowledge and perceptions in the Colombian Caribbean towards Amphibians in urban and rural settings: tools for biological conservation. *Ethnobiology and Conservation*, 1-22. doi:10.15451/ec2021-05-10.24-1-22
- Villarreal, J. D., Antón, A., Zuazagoitia, D., & Nuño, T. (2018). Young children's understanding of plant life: a study exploring rural-urban differences in their drawings. *Journal of Biological Education*, 52(3), 331-341. doi: 10.1080/00219266.2017.1385505.
- White, R., & Gunstone, R. (2014). *Probing understanding*. New York: Routledge Publication.

Xie, F., Lau, M. W. N., Stuart, S. N., Chanson, J. S., Cox, N. A., & Fischman, D. L. (2007). Conservation needs of amphibians in China: A review. *Science in China Series C: Life Sciences*, 50, 265-276. doi: 10.1007/s11427-007-0021-5.

Yıldırım, A., & Şimşek, H. (2016). *Qualitative research in social sciences*. Ankara: Seçkin Publications.

Yore, L. B., & Boyer, S. (1997). College students' attitudes towards living organisms: The influence of experience & knowledge. *The American Biology Teacher*, 59(9), 558-563. doi: [10.2307/4450383](https://doi.org/10.2307/4450383).

APPENDIX

Appendix 1. Survey on Emotions and Thoughts towards frogs

Female - ☐ Male - ☐ Grade:

Dear Students,

This survey was prepared to determine your emotions and thoughts about frogs.

* Your answers will not be evaluated as marks.

** Your answers will be strictly confidential and will not be shared with anyone.

*** If there are disturbing statements in the sentences below, you may stop answering and submit the form.

1. Fill in the blank spaces in the sentence below, as appropriate.

Frogs are like/resemble Because.....

2. What are the first things that comes to your mind when you think of frogs? Draw a picture that reflects your emotions and thoughts about frogs. Describe your drawing briefly.

3. Please answer the following questions briefly according to your own opinion.

- A. Are frogs important creatures? Why?
- B. Do you sympathize frogs? Why?
- C. Do you know about frogs? If yes, what are they?
- D. Who told you about frogs? What did they say?

APPENDIX 2. Students' drawings of frogs

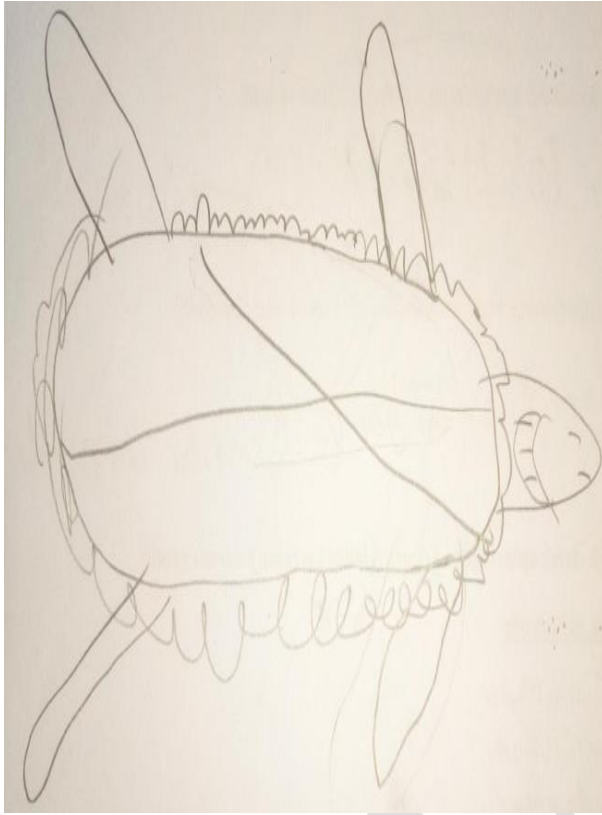


Figure 1. Drawing that compares frogs to a turtle (K₂₁)



Figure 2. Drawing about the life cycle of frogs (K₄₄)

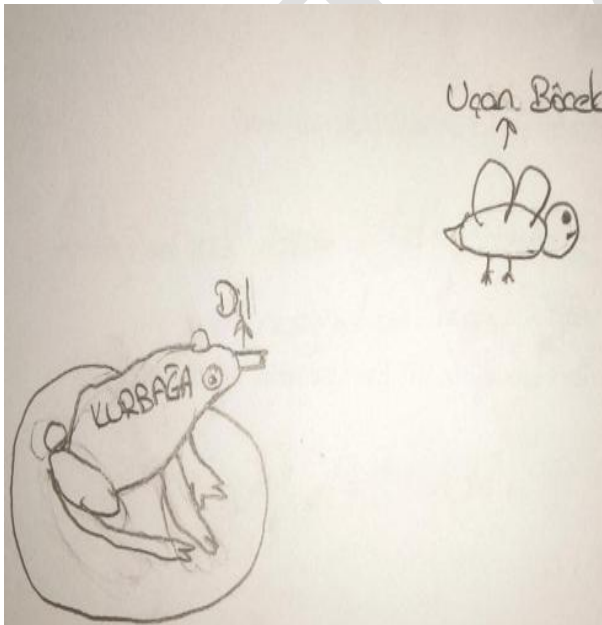


Figure 3. Drawing about frogs' nutrition (K₁₆)

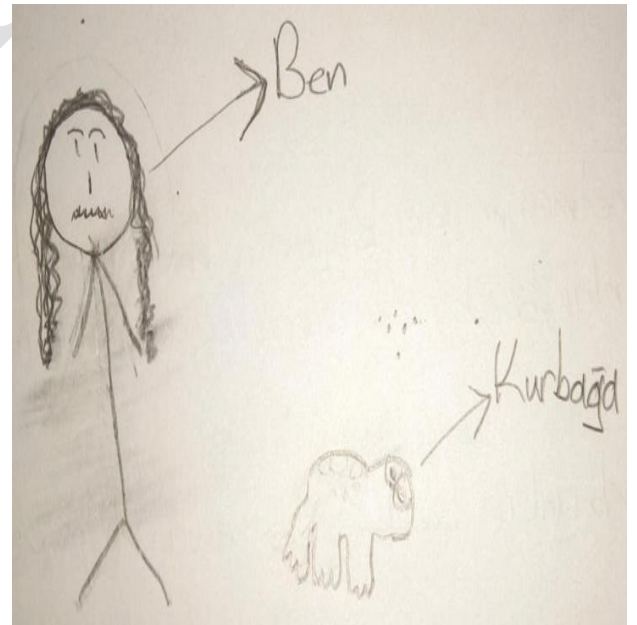


Figure 4. Drawing about not sympathizing/disliking frogs (K₃₅)