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The effect of insect workshop on students' insect intrinsic motivation

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Abstract

It is noted that insects (insecta), which constitute an important group of invertebrate animals, can be used in the field of environmental education. It is also thought that the use of insects in the classroom in the field of environmental education will have a positive effect on the insect intrinsic motivations (BİM) of the students. In the study, within the scope of environmental education, the effect of insect workshop made with *Tenebrio molitor* L. epoxy metamorphosis material on insect intrinsic motivations of students was investigated. In addition, the opinions of the students about *Tenebrio molitor* L. epoxy metamorphosis material and insect workshop were determined. In the study, case study was used from qualitative research methods. Within the scope of the research, a semi-structured interview form and observation form were used and the qualitative data obtained were evaluated by using the content analysis method. The research was conducted in the spring semester of the 2020-2021 academic year with a total of 10 volunteer students, three boys and seven girls, who were studying in the 8th grade of a primary school in Ankara, Turkey. In the research, an insect workshop prepared with epoxy metamorphosis materials showing the developmental stages of *Tenebrio molitor* L. was made. Although students have negative feelings towards insects, when they receive training about insects, it is understood that they are interested in insects, curious about them, want to learn and show interest in insect activities. It was also determined that although the students experienced disgust or fear towards insects, they wanted to make another insect material similar to the epoxy method. It shows that with similar insect workshops, the fear of insects can be reduced or even eliminated in some students. It has been determined that the insect workshop has a positive effect on the intrinsic motivation of the majority of the students. It is also understood that in the fears of insects that students have, their families and environment have a significant influence. In the research, it was seen that everyone in the families of the students who reacted most negatively experienced insect fear. From this, it is understood that the negative thoughts that students have against insects are actually due to their environment and it is thought that insect education should be given to adults.

Keywords: Environmental education, insect education, metamorphosis, *Tenebrio molitor* L., epoxy

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1. Introduction

Increasing environmental problems increase the importance of environmental education. In this context, it is necessary to provide efficient environmental education to students in understanding environmental problems and to include environmental education more in the curriculum (Coyle, 2005; Uzun & Sağlam, 2007; Legault & Pelletier, 2000). Bixler (1990) emphasized the necessity of learning about invertebrates for environmental education while focusing on the rich diversity of the world by touching many harmless insects. However, most people do not have sufficient awareness of the life and importance of invertebrate animals. Feeling a great fear and hatred toward insects and spiders, they destroy them unnecessarily (Kellert, 1993; Weeks & Oseto, 2018). In addition, it has been determined that students generally classify animals only as vertebrates (Wandersee et al., 1994). Accordingly, it is understood that students' knowledge about invertebrates is limited. However, entomologist E. O. Wilson (1987) pointed out that invertebrates are more important than vertebrates in maintaining ecosystems and that if they disappear, humans will soon disappear as well. In this context, the importance of teaching invertebrates effectively is understood. Weeks and Oseto (2018) stated that insects (Insecta), which constitute an important group of invertebrate animals, can be used in the field of environmental education. It is also thought that the use of insects in the classroom in the field of environmental education will have a positive effect on students' Insect Intrinsic Motivation (IIM). In addition, the use of insects as a teaching tool is economical, effective, and interesting and feeds students' natural curiosity about the world around them (Matthews et al., 1997).

It is stated that the environmental-based gains in the curriculum are those that are learned hands-on, and that can be obtained with long observations (Tanrıverdi, 2009). Activities in nature enable students to communicate with the environment and learn the concepts included in environmental education by doing and living (Karataş & Aslan, 2012). Kete and Ensari (2010) reported that teaching materials provide permanent and interactive learning. The fact that most children are concrete-oriented and their abstract thinking capacity is generally not at the desired level even between the age of 14 and adulthood (Bybee & Sund, 1990; Inhelder, 1958; Kuhn, 1979), highlights the use of tools in the teaching of environmental-based concepts.

1.1. Literature Review

In the literature, it has been observed that there are studies in formal and informal learning environments at all levels from primary school to university. All studies indicate that students have limited knowledge about insects and have misconceptions about the concept of metamorphosis (Barrow, 2002; Murat et al. 2010; Shepardson, 1996; Strommen, 1995; Tamir et al. 1981). It has been determined that students interpret the

concept of metamorphosis as "an organism's being different when it is small and different when it is large", "the change of a living thing and the transformation of a living thing into another" (Murat et al. 2010; Sinanoğlu, 2017). In a similar study, it was seen that students confuse the phenomenon of metamorphosis with the change of state (Hürcan & Önder, 2012). However, while growth is a common feature for all living things, metamorphosis is not seen in every living thing and metamorphosis is not a growth event. In addition, Tamir et al. (1981) in another study examining the concept of metamorphosis, it was determined that students accepted the pupa as dead because it did not move at all. Shepardson (1996) stated that first-year students' knowledge of insect life cycles was limited to their daily experiences with butterflies and moths, and they could not fully explain the life cycle of butterflies and moths.

As a result of the studies, it is understood that insect activities are also interesting and suitable for environmental education (Heyborne et al., 2012; Matthews, 1997; Schoeffler 2019). Heyborne et al. (2012), determined that the students developed positive thoughts toward insects at the end of the activity involving insect dissection for university students. Schoeffler (2019) has shown that insects can be used in teaching the concept of biodiversity and that students can also recognize the environment by recognizing insects. At the end of the activity, it was determined that the students developed positive thoughts toward insects.

1.2.Importance of the study

Because of their number and importance, insects provide an excellent opportunity to introduce students to science. Using insects as a teaching tool is inexpensive, effective, and interesting for students, and nurtures students' natural curiosity about the world around them (Matthews, 1997). Children's previous experiences and emerging ideas about insects should be taken into account when planning education (Driver et al., 1994). Therefore, it is thought that insect training should be given comprehensively for an effective training plan. The aims of insect education can be listed as follows.

- ✓ To inform students about insects, which constitute the largest group among living things.
- ✓ To inform students about insect-human relations.
- ✓ To create a passion for students to explore insects with fun.
- ✓ To develop ecology awareness by informing students about the importance of insects in the food chain.

To increase the sensitivity of students to the problems that may arise regarding the extermination of insects.

To develop a healthy attitude toward insects by reducing negative emotions such as fear and disgust, which are mostly based on false information in students.

Insect activities are held by many science centers, organizations, and universities around the world (ASE, 2020; Demirözer, 2019; Özkan, 2015; Uzun, 2019). A safe environment can be provided with epoxy insect materials during the introduction of insects to students who have an aversion and/or fear of insects. Epoxy materials can be a solution for problems such as discomfort caused by the bad odor of formaldehyde and harmfulness to health during the examination of insects contained in formaldehyde in laboratories.

1.4. Aim of the study

The study aims to investigate the effect of the insect workshop made with *Tenebrio molitor* L. epoxy metamorphic material on the insect intrinsic motivation of the students within the scope of environmental education. In addition, to determine the students' views on *Tenebrio molitor* L. epoxy metamorphic material and insect workshop.

1.5. Problem Statement

The problem statement of the study is "Does the insect workshop with *Tenebrio molitor* L. insect affect the students' insect intrinsic motivation?". Sub-problems of the study are:

1. What is the insect intrinsic motivation of the students before the activity?
2. What is the insect intrinsic motivation of the students after the activity?
3. Is there a relationship between the insect intrinsic motivations of the students during the presentation, during the application, and after the activity?
4. What are the students' opinions about the insect workshop with *Tenebrio molitor* L.?

2. Method

2.1. Research design

The case study, one of the qualitative research methods, was used in the research (Yin 1984; 2009). Qualitative research has been interpreted in different ways, such as "interpretive research" because it includes subjective opinions based on the problem, or "field research" because it examines a problem in detail within a specific field (Baltacı, 2017). Within the

scope of the research, semi-structured interview and observation forms were used and the qualitative data obtained were evaluated using the content analysis method.

2.2. Population, sample, and sampling technique

The research was conducted with a total of 10 volunteer students, three male (M) and seven female (F), studying in the 8th grade of a primary school in Ankara, Turkey, in the spring term of the 2020-2021 academic year.

2.3. Data collection tolls

To investigate the effect of students' insect workshop experiences on insect intrinsic motivation, semi-structured interview questions were prepared by the researcher by scanning the literature (Deci & Ryan, 1980; Weeks & Oseto, 2018) (see Appendix 1). To determine the content validity of the questions, the opinions of five field experts were taken. The interviews of the students who participated in the application were audio-recorded after obtaining the permission of their parents, and then they were transcribed, and codes were created. The generated codes were checked by the researcher 3 times at different times.

To observe the behavior of the students towards insects before, during, and after the activity, a 5-point Likert-type observation form was prepared by the researcher using the literature (Deci & Ryan, 1980; Gündoğdu, 2012; Weeks & Oseto, 2018; Yalın, 2003) (see Appendix 2). The observation form was composed of 4 subgroups (Interest/Pleasure, Effort/Importance, Value/Usefulness, Pressure/Stress) (Table 1). The data obtained from the observation form were evaluated with the participant observation method (Dönmez, 2016). In this study, the observers consisted of two different science teachers in the observation area. Consistency among observers was provided by the Cohen Kappa Statistic (Cohen, 1960; Landis & Koch, 1977). The items in the observation form were calculated separately for each student.

Table 1. Intrinsic motivation subgroups and explanations used in the preparation of semi-structured interview questions

Intrinsic motivation subgroups	**Aim**	**Sample Questions**
Interest/Pleasure	It is used as a positive determinant of students' intrinsic motivation.	What are your thoughts on insects?
Effort/Importance	It is used as a determinant in assessing the student's relevance to the material and activity.	Why do you think insects are important?
Value/Usefulness	It is used as a determinant in the evaluation of the student's internalization of the activity.	Would you consider making other insect materials with the epoxy method you learned?
Pressure/Stress	It is used as a negative determinant of intrinsic motivation.	Did you feel any fear/distaste for insects before using the prepared insect material? Can you explain?

2.4. Preparation of Instructional Materials to be Used in the Study

Tenebrio molitor L. insects were used in the study. *Tenebrio molitor* L. was determined most closely to their viability with 70% ethyl alcohol in the larva, pupa, and adult developmental stages. Then, ½ of the resin and hardener was sampled, and 10 ml of the epoxy mixture was poured into the molds, and *Tenebrio molitor* L. insects were embedded in epoxy according to their developmental order. The epoxy in the mold was dried with the help of a UV led lamp and 10 ml more epoxy was added on it. Then the material was sanded and the scratch and dullness problems were removed with the help of paste and polish. In addition, the QR code feature was added to the epoxy insect materials, enabling students to benefit from the material not only in the tactile aspect but also in the auditory and visual dimensions (Figure 1).

Figure 1. Epoxy metamorphic materials showing the developmental stages of Tenebrio molitor L.

2.5. Insect Workshop Application

Tenebrio molitor L. (meal worm) used in the research is an insect species that is produced and used both in human nutrition and in feeding pet animals (Huis et al., 2013; Işık & Kırkpınar, 2016). Complete metamorphosis in *Tenebrio molitor* L. species; egg, larva, pupa, and adult developmental stages are observed (Ravzanadii et al., 2012; Çalışlar, 2017). The reasons for choosing the *Tenebrio molitor* L. insect are that it is cheap, easy to find, a species undergoing metamorphosis, being traded as animal feed, and the ecological role of insects can be discussed because it is included in the group of harmful insects.

The materials (epoxy metamorphosis insect material, worksheet, PowerPoint presentation) and content of the insect workshop were prepared by the researcher. The

insect workshop activity was implemented in three lesson hours (120 minutes) according to the 5E model. Workshop content is follows;

1. It contains a PowerPoint presentation that includes basic information and converts consisting of the general characteristics of insects, their benefits in the ecosystem, their usage areas, their economic potential, and especially the developmental stages of insects.

2. Epoxy metamorphosis materials and worksheet (see Appendix 3), showing the developmental stages of *Tenebrio molitor* L. insects, were introduced to the students. Thus, the students were allowed to examine in detail morphological features and developmental stages of insects (the concept of metamorphosis) (Figure 2). The structures of insects, their life cycles, their place in the ecosystem (benefits and harms), economic values, and important insect species were made in the form of mutual question and answer.

Figure 2. Application phase of the insect workshop

3. Results

3.1 Findings Related to the Problem of the Research

To find an answer to the question "Does the insect workshop with *Tenebrio molitor* L. insect affect the students' insect intrinsic motivation?", the findings related to the following sub-problems are given.

1- The data obtained from the semi-structured interview with the students for the answers to the sub-problem "How are the insect intrinsic motivations of the students before the activity" are given in Tables 2 and 3.

Table 2. Data on students' insect intrinsic motivation before the activity

Semi-Structured Interview Questions	**Category**	**Sub Categories**	**Codes**	**Students**
1- "What are your thoughts on insects? How do you feel about insects?"	Students' feelings about insects	Positive	Likes	F6
		Negative	Disgusted	F2, F3, M3
			Afraid	F1, M1, M2, F4, M3, F5, F6, F7
			Doesn't like	M2
2- "Do you think insects are important? Why? Do you think insects are beneficial to the ecosystem?"	Students' thoughts on Insects	Important	Food chain	F2, M1, M2, F7
			Ecosystem	F1, F2, F3, M2, F7
			Food source	F1, F4, M2, M3, F5
			No idea	F6
3- "Have you had any negative moments with insects? Was there an incident that negatively affected you against insects?"	Having negative memories	Have	Damage	F1, F4, M1
			Disgust	F2
			Contact with your body	M3, M5
		Haven't	-	F3, M2, F6
4- "Have you ever destroyed insects before? Have you harmed insects?"	Cases of extermination of insects	-	Being in the living area	F1, F3, F6
			Fear	F2, F4, F7
			Threat to himself/herself	M2, M3, F5

Table 3. Some statements in which students expressed their feelings about insects before the activity

Semi-Structured Interview Questions	**Responses from some of the students**
1. How do you feel about insects?"	(F4) "I am afraid of insects. For example, when they touch me or when I see them from afar, I tremble and retreat immediately." (M2) "It is unthinkable that I like insects very much, I mean, I don't know if it's because of my fear or if there is another reason why I don't like them." (M3) "What can I say, teacher, I'm a little bit disgusted." (F1) "The little ones. I don't know where it's coming from so it's a little scary because it's unexpected." (F2) "So I think a little negatively… Very close images and all."
2. "Do you think insects are important? Why? Do you think insects are beneficial for the ecosystem?"	(F2) "*So I'm actually a little uncomfortable with their light image, but after yesterday's lesson it got me a little bit of a scientific interest."* (F6) *"When I see the insects, of course I still smell them at first. But at the same time, that's how I like it. Because of small insects. So they're sweet."*
3. "Have you had any negative moments with insects? Has there been an incident that has negatively affected you against insects?"	(F1) "He hurt many people around me so seriously that he was hospitalized. It also makes me nervous a little bit frankly." (F2) "Because I usually have the chance to examine it closely, because I examine the inside and stuff like that." (F4) "Yes. I found a bee in my grandfather's garden, it stung me. But nothing bad happened. He just stung." (F5) "I'm afraid of some insects because they got into my ear."
4. "Have you ever exterminated insects? Did you harm the insects?"	(F1) "Yes. I usually kill when they walk around my room." (F3) "Yes. When there are bugs or bees on the balcony, we can't get them out." (M2) "Yes. I killed it yesterday. It was a big insect. I killed it in this garden. My arm was about to hit, so I killed it." (M3) "Of course, teacher. The bug was trying to get on me."

As seen in Tables 2 and 3, before the activity, some students stated that they were afraid of insects (F1, F4, F5, F6, F7, M1, M2, M3) and were disgusted with insects (F2, F3, M3). Only one student stated that he loved insects even though he was afraid of them. It was observed that the students talked about the importance of insects in the food chain, their benefits in the ecosystem, and that they are a source of food for other living things. Although insects are used in a wide variety of fields, students only mentioned three related fields. For this reason, it is thought that students do not have sufficient knowledge about insects. In addition, it was understood that the students had

negative memories about insects (F1, F2, F4, M1, M3). However, it was understood that all of the students had destroyed the insects beforehand. It is understood that when the students find insects in their living spaces, they perceive them as a threat, and they kill because they have a fear of insects.

2. What is the insect intrinsic motivation of the students after the activity? The data obtained from the semi-structured interview with the students for the answers sought to the sub-problem are given in Tables 4 and 5.

Table 4. Data on the insect intrinsic motivation of the students after the activity

Semi-Structured Interview Questions	**Category**	**Subcategories**	**Codes**	**Students**
1- "What do insects mean to you?"	Students' feelings about insects	Positive	Interested	F2, F7, M1, M2
			Likes	F5, F6
		Negative	Disgusted	F2, F3, M3
			Afraid	F1, M1, F4, M3, F5, F6, F7
		Neutral	No feeling	M2
2- "Why do you think insects are important? What are the uses of insects?"	Students' views on why insects are important	-	Food chain	F1, M1, M2, F2, F4, F7
			Ecosystem	F1, F2, F3, M2, F7
			Food	F1, F4, M2, M3, F5
			Economy	F2, M1
			biodiversity	F3, M3, F7
			Textile	M1
			Agriculture	F5
			In drug making	F5, F6, F7
3- "How has your opinion of insects changed?"	The effects of the insect workshop on students' thoughts about insects	Positive	love more	F5
			not to be disturbed anymore	M1
			learning about insects	F1, F4, F5, F6, F7
			A more scientific approach	F2, F3, F4, F7
			no longer thinking about killing	F4, M2, F6, F7
		Negative	had no effect	F7
				M3
4- "How did you feel while doing the insect workshop	Students' feelings about the insect workshop		more afraid/disgusted	F1
			Strange	F2, F7

activity?			find interesting	F3, F6
			Enjoyable/ Pleasant	M1
			like a seminar	M1, M2, F7
			Good/Nice	F4
			Confused	F4, F7
			Excited	M2
			Enjoyable	F5
			Successful	M3
			Disgusting	F2, M2
5- "Would you be willing to do a similar activity? Why would you want to participate?"	Conducting another activity similar to the students' insect workshop thoughts	Should be done	so much fun	F1, F5
			Very different	F2, F4, M2, F7
			More information	M2, F7
			Interesting	F6
			Very helpful	F2
			make people love	M1
		Should not be done	Disgusts more	M3
6- "What do you think about insect activities? Why do you think insect activities should be included in education?"	Students' thoughts on including insect activities in education	Insect activities should be done	Interested	F2, F7
			learning about insects	F1, F3, M1, F4, M3, F5, F6
			Overcoming the fear of insects	F1
			Gaining a different perspective	M2
7- "Did you actively participate in the activity while doing this activity? Can you explain?"		Active participation	In insect presentation	M1, F4
			While reviewing the materials	F1, F2, F3, F5, F6, F7, M2, M3,

Table 5. Some statements of students regarding insect intrinsic motivations after the activity

Semi-Structured Interview Questions	**Responses from some of the students**
"What do insects mean to you?"	(F2) "I mean, I'm actually a little annoyed by their light appearance, but after yesterday's lecture, I was a little bit scientifically interested." (M2) (M2) "I wasn't in love, I wasn't in love. So nothing made any difference. (F4) "So after what we did on Wednesday, some of my thoughts on insects have changed. For example, I learned some things. I learned that insects contribute more to nature. I learned these. I'm still a little afraid of bugs. But I think I'm not afraid like I used to be." (F6) "Of course I still smell at first when I see insects. But at the same time, I actually like it that way. Because little insects. So they're sweet."
"Why do you think insects are important? What are the	(F2) "In other words, they have great benefits for the economy, and they are very important both ecologically and in terms of balance, so if we think of it as if we are eating it."

uses of insects?	(M1) "Insects… Of course, I wouldn't answer this as an ecosystem, it will be general. I mean, I know it because things are like that. But of course, according to what you have told, since diversity constitutes most of the living things in the world, they also perform many tasks. In many fields… It is a living thing that is very useful for people… It works for people in everything, textile, economy." (F7) "I think it is important for the ecosystem and for the continuation of life. Medicine making and stuff."
"How have your thoughts towards insects changed?	(F2) "I approached it more scientifically, not just seeing its appearance and not being disgusted. That feeling of disgust faded slightly. I learned about the benefits to the world and all." (M3) "My teacher didn't change anything. I am disgusted again. I am afraid again." (F6) "It affected more positively. Thanks to this, I started to like insects more and more. Because they actually help our lives a little bit." (F5) "So, I learned that they are animals and they need them too. So of course I treat them better now. I'm starting not to kill."
"How did you feel while doing the insect workshop activity?	(F2) "I mean, it was very interesting, I've never made a model of an insect before. These three versions cocoon adult larva." (M2) "So it was fun, I was happy. For example, it was very good to get away from the stress of LGS, to take lessons and learn new information. For example, I learned about arachnids for the first time…" (M3) "So teacher, the photos are a bit disgusting. So disgusted. I am more disgusted with insects. I will say so." (F4) "So this is the first time I've been so closely interested in insects. I learned something. So I was surprised, excited. Because there are so many different insects…"
"Would you be willing to do a similar activity? Why would you want to participate?"	(F2) "I wish yesterday was a lot of fun and I would like to learn more. I did not know the stages of these insects before, if we do other activities, I can have more information about insects." (F4) "Of course I would. After all, I would get to know insects better. For example, I was very happy when I came here, but I did not expect that I would learn so much. I didn't know what we did with those little bugs. I would come. I would have learned a lot more." (M2) "I think it would be nice, sir. As I said, teacher, in terms of entertainment. And in terms of learning new information, I think."
"What do you think about insect activities? Why do you think insect activities should be included in education?"	(F2) "Actually, it would be very nice, actually, not everyone is looking very well. Some people don't like it very much, but those who like and are interested can do it, I think, and it would be very nice." (M2) "I think my teacher can be nice. That would be interesting. It would be something like a different point of view, I think it would be nice." (F4) "Of course I would. After all, I would get to know insects better. For example, I was very happy when I came here, but I did not expect that I would learn so much. I didn't know what we did with those little bugs. I would come. I would have learned a lot more." (F6) "I would love to. Because I think it can really contribute to people's lives. I think the contribution of insects is great in medicine, in all kinds of things…"

"Did you actively participate in the activity while doing this activity? Can you explain?"	(F1) "Teacher… Well… I think, there are things we do like this? Ornaments… I mean, materials. Handling them." (M1) "I was watching the presentation very carefully because I learned information that I did not know at all. If there was one thing I knew, I would have been distracted. But, for example, I think that I listened very well because I learned a lot of different information." (F6) "Well… while reviewing the materials. The slides also intrigued me. I also attended there.

In the interviews held before the activity, some of the students stated that they were afraid of insects (F1, M1, M2, F4, M3, F5, F6, F7) and were disgusted with insects (F2, F3, M3). In addition, F5 coded students stated that they "Loved" insects after the activity, and F2 and F7 coded students stated that they were "Interested" towards insects after the activity. However, the M2 coded student changed his thought to "Neutral" by stating that he did not feel anything against insects. It is seen that the students gave more examples of usage areas related to insects after the activity.

Different from before the activity, the statements given by the students after the activity; economy, biodiversity, textile, agriculture and drug production. However, M3 coded student stated that he was more disgusted with insects after participating in the insect workshop activity. When the reason for this situation was asked, it was understood that the student felt worse because of some insect photos in the insect presentation. In addition, although the student coded K7 said that the activity did not affect his thoughts, it was also seen that the student no longer thought of killing insects and stated that by learning about insects, he approached them more scientifically.

It is understood that the students felt various emotions (interesting, pleasurable, funny, exciting, fun, etc.) in a positive way (F1, F2, F3, F5, F6, M1, M2) while doing the insect workshop. After the activity, all students, except for the E3 coded student, stated that other activities similar to the insect workshop should be done. Among the reasons why students wanted other activities similar to the insect workshop, the most expressed code was "more information" (F2, F4, M2, F7). It is thought that although students have negative feelings towards insects, they are interested in insects, they are curious about them and they want to learn about them.

It is seen that all of the students stated that there should be insect activities in education. The codes for the answers of the students; It has been grouped as "making people love", "being interested", "learning about insects", "overcoming the fear of insects" and "gaining a different point of view". It is understood from these codes that the code "learning insects" (F1, F3, M1, F4, M3, F5, F6) was emphasized the most. It is seen that all of the students think that they actively participate in the insect workshop. In addition, it was determined that students participated more actively (F1, F2, F3, M2, M3,

F5, F6, F7) while examining epoxy metamorphic materials. This shows that the epoxy metamorphosis material used in the event provides active participation in the event.

3. Is there a relationship between the insect intrinsic motivations of the students during the presentation, during the application, and after the activity? The data obtained from the observation of the students in the process regarding the sub-problem are given below.

Table 6. Evaluations regarding the observation of students in the process

Criteria to be observed	Students									
	F1	F2	F3	M1	F4	M2	M3	F5	F6	F7
Stage 1: Pre-Event										
She/he asked questions about the content of the event. *Interest/Pleasure*	x		x	x	x			x		
She/he showed a dislike/fear response to insects. *Pressure/ Tension*	x	x	x	x	x	x	x	x	x	x
She/he was able to give examples of the insect species he knew. *Effort/importance*						x				
She/he was able to give examples of the usage areas of insects (industry, pharmacology, agriculture, forensic medicine, etc.). *Effort/importance*	x			x				x		x
She/he was able to describe the physical characteristics of insects. *Effort/importance*				x						
She/he was able to give examples of the ecological importance of insects. *Effort/importance*		x				x	x			x
She/he was able to explain the concept of metamorphosis. *Value/ Usefulness*										
She/he showed interest in the event materials. *Interest/Pleasure*	x	x	x		x	x	x	x		x
Stage 2: Implementation Sequence										

She/he listened carefully to the event. *Effort/importance*	x	x	x	x	x			x		
She/he found the preparation phase of the epoxy material interesting. *Interest/Pleasure*	x	x		x	x	x	x		X	X
She/he guessed/tried to guess the meanings of the concepts in the activity. *Effort/importance*						x				
She/he associated the information he learned with his daily life. *Value/ Usefulness*	x	x		x		x		x		x
She/he estimated/tried to estimate the benefits of insects to the ecosystem. *Effort/importance*	x			x						
She/he asked questions about insects. *Interest/Pleasure*		x			x	x	x			x
She/he was able to use the epoxy insect material with ease. *Value/ Usefulness*	x	x	x	x	x	x	x	x	x	x
She/he continued to show a displeasure/fear response to insects. Pressure/Tension	x	x					x		x	
Stage 3: Post-Event										
She/he participated in the ethical debate on the extermination of insects. *Value/ Usefulness*		x	x	x	x		x	x		
She/he continued to study the epoxy insect material. *Interest/Pleasure*		x	x	x	x	x	x	x	X	x
She/he asked about insects and epoxy insect materials. *Effort/importance*				x		x				
She/he continued to show a displeasure/fear response to insects. *Pressure/Tension*	x	x					x		x	
She/he was able to describe the morphological features of insects. *Value/ Usefulness*	x			x		x		x		x
She/he was able to explain the concept of metamorphosis. *Value/ Usefulness*			x	x	x	x	x			x

When Table 6 was examined, it was determined that the students had the most 'dislike/fear response towards insects' before the activity, that is, the insect showed the Pressure/Tension dimension of the intrinsic motivation and the 'interest / pleasure dimension'. In addition, no student has been able to explain the concept of metamorphosis. They could not give examples of insect species for the dimension of Effort/Importance intrinsic motivation and could not explain the physical characteristics of insects. But they have responded more to the ecological importance of insects and the uses of insects.

The students' 'discontent/fear response to insects' during the application the Pressure/Tension dimension was observed in eight students before the application, while it was observed in four students during the application. It was observed that all of the students could easily use the epoxy insect material (Value/Usefulness) and that they found the preparation stage of the epoxy material interesting (Interest/Pleasure). In addition, it was understood that students who felt pressure/tension had difficulty in rerelating the information they learned with their daily life (Value/Usefulness).

After the event, the students continued to study the epoxy insect material (Interest/Pleasure). It was observed that six students were able to explain the concept of metamorphosis and five students were able to explain the morphological characteristics of insects (Value/Usefulness). This situation shows that the Pressure/Tension dimension has improved compared to before the application.

4. What are the opinions of the students about the insect workshop with the prepared *Tenebrio molitor* L.*?* The data of the sub-problem are given below.

Table 7. Students' opinions about the *Tenebrio molitor* L. insect workshop

Semi-Structured Interview Questions	**Category**	**Subcategories**	**Codes**	**Students**
1- Would you consider making other insect materials with the epoxy method you learned?	Students' requests to prepare other insect material with the epoxy method	-	Enjoyable	F1, F3, F6, F7
		-	Informative	F2, F5
		-	Population anxiety	M1, F4
		-	Scary	M2, M3
2- Do you think that the prepared insect activity is suitable for your education level? What are your thoughts on the prepared	Students' thoughts about epoxy insect material	Positive	Can be stored	M3
			Portable	F1
			Effective in overcoming fear of insects	F2, F6, F7

materials? Do you think these materials were effective in overcoming/reducing your fear/displeasure for insects?			Examining insects in detail	F7
			Changed his perspective	F3, F5, F7
			Useful/ Efficient	F4, M2
			Well prepared	F1, F2, F3, F4, F5, F6, M1, M2,
		Negative	It looks bad	F1
			Not effective in overcoming fear of insects	M3, F7
3- How did you feel while doing this activity? Do you think the prepared insect activity is suitable for your education level?	Students' thoughts on insect presentation	Positive	Teaches insects	F6, F7
			It was understandable	F1, F4, F6
			It was suitable for my education level	F1, F2, F3, F4, F5, F6, F7, M1, M2, M3
		Negative	There was too much information	F1, M1
			Some insect photos were bad	F1, M1
4- Could you easily use the prepared materials individually?	Students' ability to use materials individually	-	Easily	F1, F2, F3, M1, M2, M3, F5, F6, F7
		-	Can be forced	F4
5- Do you have any suggestions about the prepared materials?	Students' suggestions about materials	-	Prepare as accessories	F1
		-	Using glass containers instead of resin	F2
		-	Materials may look a little more lively	F4
		-	No suggestions	F3, F5, F6, F7 M1, M2, M3,
6- Did you feel any inadequacy/difficulty while doing this activity?	The situation of students feeling inadequacy/difficulty in the activity	Insufficient	In insect presentation	F1
			To learn the structures of insects	F2
			In question answer	M1
			At the first touch of the material	F4, F6, M3

		Sufficient	At no stage	F3, M2, F5, F7
7- Does anyone in your family have a fear of insects? Who?	Does anyone in the student's family have a fear of insects?	-	Mother	F1, F6, F7, M1, M3
			Father	F1, M3
			Brother/Sister	F1, M2, M3
			Cousin	F2, F5
			Himself/herself	F1, F2, F3, F4, F5, F6, F7 M1, M3

Table 8. Some expressions of the students' opinions about the *Tenebrio molitor* L. insect workshop

Semi-Structured Interview Questions	**Some of the students' answers**
Would you consider making other insect materials with the epoxy method you learned?	(F2) "I wish yesterday was a lot of fun and I would like to learn more. I did not know the stages of these insects before, if we do other activities, I can have more information about insects." (M1) "I mean, I wouldn't want too many insects like that, though. People start to take a lot of interest. If we do it to every insect, it would be too much." (F4) "I wish it wasn't too big. I wish there were insects that we didn't kill ourselves, that you brought in, that will die, or that you can kill with easier methods. So I would."
Do you think the prepared insect activity is suitable for your education level? What are your thoughts on the prepared materials? Do you think these materials were effective in overcoming/reducing your fear/displeasure for insects?	(F6) "I think the materials were pretty good. It also made me not afraid. At first, I thought I couldn't get used to it. I think it would be fine if they were dead too. Because if they were alive, I would be a little scared, but next time maybe they will be alive." (F7) "I thought it was pretty interesting. There were those parts, the egg and larva part, it was very interesting and beautiful, I think."
How did you feel while doing this activity? Do you think the prepared insect activity is suitable for your education level?	(F5) "At first, you said take it. Then I was startled. I said is he alive or something? Then I bought it. I liked it so I bought a few more. I started to examine it with gloves… It was nice. I got it after that. I actually fused with the insect…"
Could you easily use the prepared materials individually?	(F7) "Yes, I examined it very easily, it looked comfortable, so even its legs were visible."

Do you have any suggestions regarding the prepared materials?	(F1) "They could have been like necklaces. I think I would. It would be interesting because no one else has it." (F4) "I like the ones that look a little morelively and transparent. It could be. I also showed it to my siblings. They liked it too."
Did you feel any inadequacy/difficulty while doing this activity?	(M1) "Of course, I didn't know much about this subject. I asked my family members that every insect has 6 legs, and no one knew." (M3) "The earwig was disturbed by the insect presentation." (F4) "I did not live. I just got a little scared when the bug landed on my hand."
Does anyone in your family have a fear of insects? Who?	(M1) "Our family is not so afraid of such things. I am more afraid. My mother is a little more afraid." (F4) "Fear of insects… My brothers are not afraid at all. My mother and father would be afraid if they saw a scorpion, but they would not be afraid of flies." (M3) "Everyone…" (F6) "Yes, there is someone who has a fear of insects. Just today, my mother saw an insect in the house. She said Ecem will you take this? I went to her and took the insect with a napkin."

When table 7 and 8 are examined, it is seen that although they experience disgust or fear towards insects, the students want to make another insect material similar to the epoxy method (F1, F2, F3, F5, F6, F7). In addition, the students stated that epoxy insect material is effective in overcoming insect fears. At the same time, the students talked about the usefulness/efficiency of the materials as they could examine the epoxy materials and insects in detail. All of the students found the prepared insect presentation suitable for the "level of learning".

Students' opinions about the presentation; they also stated that they were able to learn about insects (F6, F7) and found them understandable (F1, F4, F6). However, students with codes F1 and M1 said that there was a lot of information in the presentation. The student with the code M3 stated that some insect photos in the presentation (Insect photo escaping to the ear) affected him badly. As a result, it is understood that all of the students think positively about the insect presentation performed. The F1 coded student stated that epoxy insect materials could be prepared in the form of accessories and thus the fear of insects of individuals could be reduced. The student coded F2 suggested that insects could be prepared in a glass container, resulting in more transparent materials.

Students F1, F2, F4, F6 M1, M3 stated that they had difficulty in the insect workshop activity. When the stages in which the students had difficulty were investigated, it was found that some of them had difficulty in presenting insects (F1), some in learning the

structures of insects (F2), some in preparing materials and first touching the material (F4, F6, M3), and in the question and answer stage (M1).

To the question "Is there a fear of insects in the family?", the students first stated themselves (F1, F2, F3, F4, F5, F6, M1, M2, M3), then mentioned the individuals in their families. According to the answers of the students; The person to whom the student expresses that he has a fear of insects in families other than himself is primarily their mother (F1, F6, F7, M1, M3). Later, they mentioned that the siblings of the students (F1, M2, M3) had a fear of insects. The person who was stated to have the least fear of insects in the house was the fathers (F1, M3). He also emphasized that the students' cousins had a fear of insects (F2, F5). These results draw attention to the fact that the fear of insects in children may be primarily influenced by the mother.

4. Conclusions and Discussion

Although insects are used in a wide variety of areas, it was found that students could only tell three areas of use that were related to each other before the event. In this case, it can be said that students do not have a sufficient level of knowledge about the areas of use of insects. In the literature surveys, it was determined that in many researches, students did not have sufficient knowledge about insects and metamorphosis (Barrow, 2002; Hürcan & Önder, 2012; Murat et al., 2010; Shepardson 1996; Strommen, 1995; Tamir et al., 1981). After the activity of the students, they will be interested in insects; economy, living diversity, textile, agriculture and pharmaceutical production. It is believed that the presentation of the insect workshop allows students to have sufficient knowledge about insects. It was also the highest "more information" code among the reasons students asked for other activities similar to the insect workshop to be done. In the powerpoint presentation used in the event, it is understood that it is effective to give interesting information about insects (biomimicry, economic benefits, etc.). With the insect workshop conducted in the research, it was seen that six of the students correctly explained the stages of development (metamorphosis) of insects. This result is consistent with what students can hypothetically think about when concrete examples are given (Weeks & Oseto, 2017).

Before the event, it was determined that nine out of ten students had negative thoughts about insects and seven had negative memories about insects. It was also understood that not all students easily destroy insects, even when they do not consider them harmful. Kellert (1993) also found in his research that insects are destroyed unnecessarily. After the event, it was understood that although the students (F2, F7, M1, M2, F5) were positively affected by insects, their disgust and fear against insects still continued. However, at the end of the activity (F4, M2, F6, F7), the students emphasized that they no longer wanted to kill insects. Considering that students participated in a

insect workshop activity that lasted only three class hours (120 minutes), the proportion of students who changed their minds about insects is significant.

It was determined that the students felt various emotions (different, interesting, enjoyable, seminar-like, good/beautiful, confused, exciting, fun, successful) in a positive way while doing the insect activity. In addition, except for one of the students (M3), all of them expressed the opinion that other trainings similar to insect workshops should be done so that they could learn more about insects. Again, all of the students stated that they actively participated in the event. In insect education, it was seen that applications rather than theoretical explanations, especially epoxy metamorphosis materials and power point presentation were more preferred by students.

When the active participation of the students in the insect workshop was examined, it was found that eight students were more active in explaining the insect presentation while two students examined the epoxy metamorphosis materials. In this case, it can be said that the applications attract the attention of the students more. In a study conducted by Weeks and Oseto (2018), it was determined that the practices developed positive thoughts against insects, and William H. Heyborne et al. (2012) determined that when they applied an in-class activity that included insect dissection to the students, the students developed positive thoughts against insects at the end of the activity. It is understood that the students who participate most actively during the presentation of the event are also the students with the highest intrinsic motivation. In addition, it was determined that the stage in which the students participated most actively was in the discussion environment after the event. As a result, it was found that the insect workshop positively affected the intrinsic motivation of the students.

It can be said that the fact that the students prepare the epoxy insect material themselves is effective in overcoming insect fears. At the same time, the students were able to examine the epoxy insect materials and insects in more detail and found the materials useful.

As a result; Although students have negative feelings towards insects, when they receive training about insects, it is understood that they are interested in insects, curious about them, want to learn and show interest in insect activities. It also seems that although students experience disgust or fear of insects, they want to make another insect material similar to the epoxy method. It shows that with similar insect workshops, the fear of insects can be reduced or even eliminated in some students. It has been determined that the insect workshop has a positive effect on the intrinsic motivation of the majority of the students. Weeks and Oseto (2018) also reported that practices improved positive thoughts towards insects.

It is understood that in the fears of insects that students have, their family and environment have a significant influence. In the study, it was seen that everyone in the families of the students who reacted most negatively (F1 and M3) had a fear of insects. Similarly, in other studies, it is not possible for children to make sense of things in isolation from others (Bishop, 1985; Rogoff, 1990) and that learning occurs both personally and socially (Steffe & Wood, 1990). From this, it is understood that the negative thoughts that students have towards insects are actually caused by their environment and it is thought that insect education should be given to adults.

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