A Qualitative Analysis of Students' Experiences with Emotional Design in Multimedia*

Ahmet Murat Uzun**, Zahide Yıldırım***

Abstract

For years, cognitive theories of multimedia learning have been used as the dominant theoretical framework in research on multimedia learning. In recent years, there have been significant developments in affective theories, and researchers have now started to consider the role of emotion and motivation in learning. This study explores students' views on using emotional design in multimedia learning. Students were taught with different multimedia learning materials on the topic of "work, energy, and energy conservation," which were identical in terms of the content but different in terms of the extent of emotional design elements. A qualitative study was implemented. Semi-structured in-depth interviews were conducted with 28 interviewees who used the learning materials. Based on content analysis, two main categories appeared: "Emotional Aspect of Multimedia Learning" and "Cognitive Aspect of Multimedia Learning." It was found that students had different views regarding using emotional design. The "Emotional Aspect of Multimedia Learning" category contained emotional design principles such as color, facial expressions, and sound effects. The "Cognitive Aspect of Multimedia Learning" category included cognitive elements such as interactive questions and exercises, cognitive interest, the multimedia principle, real-life examples, animations, and signaling. Results were discussed along with different opinions about emotional design in multimedia.

Keywords: Multimedia, emotional design, emotions, cognitive load.

** (iD) Corresponding Author: Afyon Kocatepe University, Faculty of Education, Turkey, auzun@aku.edu.tr.

*** (iD) Middle East Technical University, Faculty of Education, Turkey, zahidey@metu.edu.tr.

Introduction

Efforts to make multimedia materials more interesting have always been the subject of controversies in the literature. According to the cognitive theory of multimedia learning, interesting but irrelevant features may interfere with learning (e.g., seductive details), which increases the load on working memory (Harp & Mayer, 1997,1998). On the other hand, even though interesting design elements might hurt learning, their motivational benefits cannot be denied (Harp & Mayer, 1998; Park, Flowerday, et al., 2015). Considering this, researchers now do not underestimate the role of affective processing in learning and suggest cognitive-affective theories of learning, such as the cognitive-affective theory of learning with media (CATLM) (Moreno, 2006, 2007), the integrated cognitive-affective model of learning with multimedia (ICALM) (Plass & Kaplan, 2016), and the cognitive-affective model of e-learning (CAME) (Mayer, 2020). Consistent with these theories, recently, emotional design in multimedia has been offered as a new method (Heidig et al., 2015; Liew et al., 2022; Plass et al., 2014; Um et al., 2012; Wang et al., 2023). Unlike seductive details, the emotional design does not impose extra details but minimally manipulates the intrinsic design features using relevant features to foster positive emotions and learning (Heidig et al., 2015; Zhao & Mayer, 2023). The most frequently used emotional design techniques are attention-capturing bright and saturated colors, anthropomorphism, and baby face bias. Emotional design is a significant topic, but the results are mixed (Brom et al., 2018; Stárková et al., 2019).

Um et al. (2012) implemented one of the first studies on emotional design. They created two materials. The neutral design included a black-and-white scheme with no emotional design. In contrast, emotional design included anthropomorphic images (attributing human-like characters to non-humans), attention-capturing color combinations, and baby faces. Results demonstrated that Emotional Design students performed better on the achievement test. In a subsequent investigation, Plass et al. (2014) discovered that positive emotions facilitated cognitive processing and increased comprehension.

Mayer and Estrella (2014) revealed that the emotional design group outperformed the neutral design group regarding learning outcomes. Park, Knörzer, et al. (2015) demonstrated that anthropomorphism captured learners' attention in their eye-tracking study. Brom et al. (2016) indicated that anthropomorphism affected surface learning, functioning as clues to recall information. Stárková et al. (2019) observed that anthropomorphism did not affect learning outcomes and slightly affected attention allocation. Shangguan, Wang, et al. (2020) reported no main effect of emotional design on achievement (experiment 1). In light of Bülbül and Kuzu's (2021) findings, emotional animations increased the transfer score. Finally, while Slabbert et al. (2022) found no significant effect of emotional design on achievement, Wang et al. (2023) demonstrated that the colorful and anthropomorphism design yielded better transfer scores.

Despite emotional design suggesting a new means of affective design, the literature produced mixed results, and how emotional design affects learning is still unknown (Stárková et al., 2019). Furthermore, research in this area has mostly adopted quantitative between-group comparison designs to investigate the phenomena. To the best of our knowledge, only a few studies (e.g., Brom et al., 2016) employed a qualitative design. Therefore, we aim to provide a detailed interpretation of how students felt when they utilized multimedia with emotional design, with the help of qualitative design.

This study aims to understand student experiences taught by multimedia materials adopting different levels of emotional design. The following research question was posed:

- "What are students' views about using emotional design in multimedia learning?"

Methodology

Design of Learning Materials

Four instructional multimedia programs adopting different emotional design principles were developed. The unit "Work, Energy, and Energy Conservation" was addressed. This unit was addressed by the science curriculum in seventh grade published by the Turkish Ministry of National Education (Milli Eğitim Bakanlığı [Ministry of National Education], 2015).

Design principles of cognitive load theory (Paas & Sweller, 2014) and cognitive theory of multimedia learning (Mayer, 2009) were used in designing multimedia artifacts. We regularly conferred with an instructional designer, two subject area experts, and five science teachers to ask for their advice regarding the development of the materials. We followed an iterative process during the design.

We used the Neutral Design (ND) approach for the first material. We used animated drawings with only a black-and-white color scheme with an audio narration. Human characters in the material had neutral faces.

The second material was developed according to Colorful Design (CD); attention-grabbing, bright, and saturated color combinations were used instead of the black-and-white color scheme. Additionally, human characters had neutral faces, and no faces (anthropomorphism) were used for the lifeless characters.

Anthropomorphic Design (AD) was applied to the third material. Expressive faces were adopted for lifeless objects. Additionally, for humans, positive faces were applied. Consider an object being lifted to a certain height. Because of the rise in gravitational energy, the smiling of the object also changed. For the AD group, the human characters

were depicted with having positive -facial expressions as well. Yet, they were changing based on the tasks they were performing.

The last material applied the Anthropomorphic Design and Sound Effects (ADSE) approach. This material was the same as in AD, except that contextual cartoonistic sound effects were used. Sample screenshots are provided in Figure 1.

Figure 1

Sample screenshots
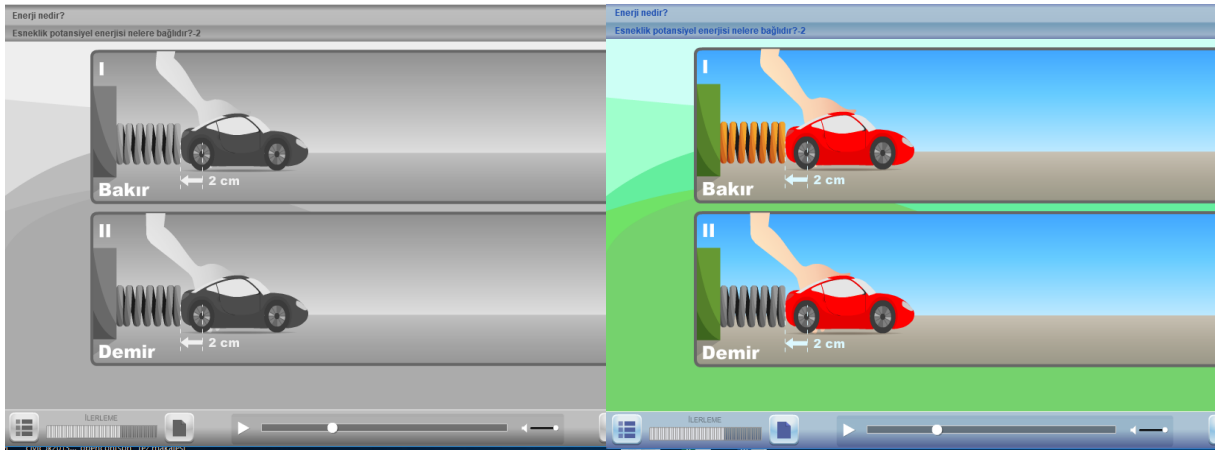
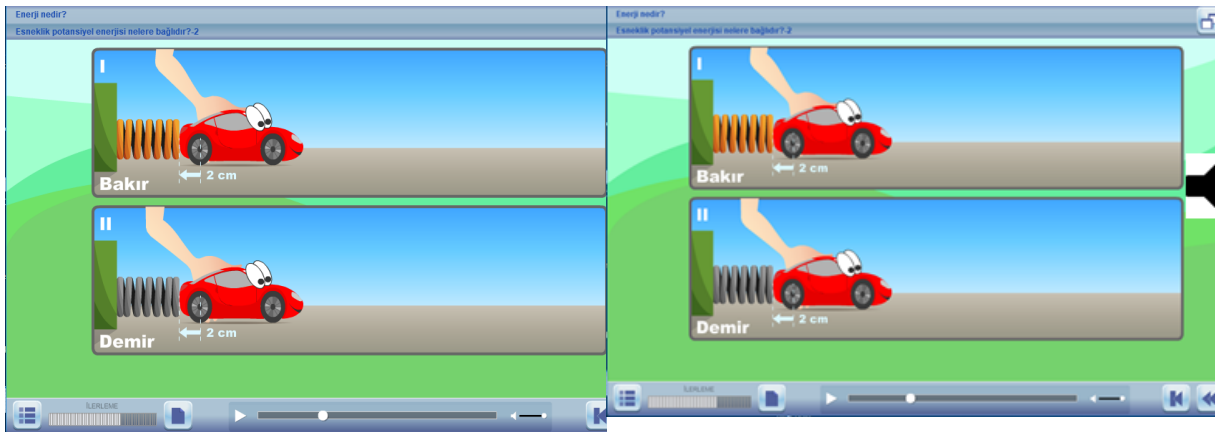**ND**   **CD**

AD   **ADSE**

Design and Participants

The study employed a qualitative research design. More specifically, a phenomenological research design was utilized to delve into students' experiences with emotional design and their meaning to this phenomenon. Students' experiences were

gathered through face-to-face, in-depth interviews. The school where the investigation was carried out had 14 classes, and four were selected for the study. The students followed multimedia course content for three weeks (one session per week) based on the duration suggested by the curriculum. For the first and second sessions, students studied the material for a one-hour class period. The third week's material lasted for an half-hour class period. Each class used a different version of the multimedia materials and was selected randomly. Based on purposeful sampling, more specifically, maximal variation sampling, only some students were recruited from the 7th graders for the interviews. The sample included 15 boys and 13 girls. Students were chosen based on their post-achievement scores and gender. First, for each condition (ND, CD, AD, and ADSE), we calculated learning achievement scores, and we analyzed students as low, average, and high achievers based on the means and standard deviations. Second, one female student and one male student were designated among each success group. Four students (ND = 2, AD = 1, and ADSE = 1) with different characteristics concerning pre- and post-achievement scores were also selected for the interviews. As a result, 28 students (ND = 8, CD = 6, AD = 7, and ADSE = 7) were chosen for all conditions for face-to-face interviews. The interview took approximately 15 minutes to implement.

Data Collection Instrument

A semi-structured interview protocol was administered during the interview, which included student perceptions on emotional design, the components of instructional content that learners enjoyed best and worst, their degrees of involvement with the course, factors that facilitated or hindered their learning, and how they sensed while taking the material. The advice of three professionals was sought to create the interview protocol. A pilot investigation was carried out involving two different learners to check the comprehensibility of the interview items. The data collection tool involved seven open-ended questions with probes. A sample question was: "What was your favorite or most enjoyable part(s) of the educational software? Why?"

Data Analysis

An iterative, sequential, and comparative analysis perspective was implemented to analyze the data. Content analysis was utilized for coding the data and creating the themes (Fraenkel et al., 2012). A theory-driven approach was adopted to code the data. The inter-coder reliability formula was applied to calculate the reliability. Six interviewees' data (20 %) was coded independently by an expert in the field. Then, we came together with an expert to discuss the codes. Inter-coder reliability was computed based on Miles and Huberman's (1994) formula:

$$\text{inter} - \text{coder reliability} = \frac{number\ of\ agreements}{number\ of\ agreements + number\ of\ disagreements}$$

Inter-coder reliability was found to be 84.7. To Miles and Huberman (1994), values over .80 or above are acceptable.

Trustworthiness and Ethics

To satisfy the credibility of the data, we applied methods such as prolonged engagement, purposeful sampling, peer examinations, and expert reviews. We ensured prolonged engagement, as the students and we knew each other for a sufficient time (three weeks of implementation time). By purposeful sampling (maximal variation), we aimed to obtain a more accurate representation of reality. To control the content validity and congruence of qualitative questions, three experts reviewed the interview protocol iteratively during the design and development phases of the protocol. Another approach that we used was the peer check. As Ruona (2005) suggested, we asked one of our colleagues to interpret the findings during various stages of the qualitative analysis. We achieved dependability (reliability) by inter-coder reliability analysis. To increase the transferability of the data, categories and sub-categories derived from the data were tabulated. Furthermore, direct quotations of interviewees' responses were included in the analysis report.

Before conducting the study, we consulted the university's applied ethics research center. After evaluation, the human research committee decided that the research did not include any ethical violations and gave the necessary approval. Only volunteer students participated in the study, and students' responses were kept confidential, and the results were used only for scientific purposes. The research report did not include any participants' identities.

At the beginning of the study, the students were given information about the researcher's role. They were informed that they received the course as a part of the research study. Students received the instruction for three weeks, and the researcher helped them if they faced any difficulties. After the instructional process ended, researchers conducted face-to-face semi-structured interviews with students. In this phase, the researchers endeavored to cultivate a close, trusting, intimate, warm, and empathetic relationship between the interviewer and the interviewees to get accurate responses to the questions being asked (Yıldırım & Şimşek, 2011).

Findings

Content analysis revealed two main categories, one of which was named "Emotional Aspect of Multimedia Learning," whereas the other was called "Cognitive Aspect of Multimedia Learning." Codes, coding frequencies, sub-categories, and categories are given in Table 1 and Table 2.

Table 1

Category of "Emotional Aspect of Multimedia Learning," Related Sub-Categories, and Coding Frequencies

Categories	Codes		Cases (N)	Counts (f)
Color	Appealing/Pleasing		15	21
	Attention Grabbing		10	15
	Boring		5	6
	Facilitating		2	4
	Neutral		1	1
	Distracting		1	1
Facial Expressions	Facial Expressions of Human Characters	Positive Energy	5	5
		Interesting	3	3
		Facilitating	2	2
		Attention Grabbing	2	2
	Expressive Anthropomorphism of Lifeless Objects	Distracting	6	11
		Entertaining	6	6
		Attention Grabbing	5	6
		Facilitating	5	6
		Being Redundant / Absurd	5	6
		Interesting	5	5
		Appealing/Pleasing	4	5
Sound Effects	Appealing/Pleasing		8	9
	Distracting		6	8
	Sense of Reality		6	7
	Attention Grabbing		4	5
	Neutral		3	4
	Disturbing		2	5

Table 2

Category of "Cognitive Aspect of Multimedia Learning" and Coding Frequencies

Codes	Cases (N)	Counts (f)
Interactive Exercises and Questions	18	28
Cognitive Interest	11	20
Multimedia Principle	12	17
Real-Life Examples	8	11
Animations	6	7
Signaling	3	4

Emotional Aspects of Multimedia Learning

Students' opinions regarding emotional design approaches, such as attention-grabbing color combinations, facial expressions, and sound effects, were discussed in this

category. Hence, three sub-categories were formed: "Color," "Facial Expressions," and "Sound Effects." The sub-category of "Facial Expression" was further divided into two new sub-categories: "Facial Expression of Human Characters" and "Expressive Anthropomorphism of Lifeless Objects."

Color

The most frequent code (f = 21) in this category was the perception of being "Appealing/Pleasing" of the colors. Students (N = 15) thought that colors were pleasant, and the use of attention-grabbing colors made multimedia materials seem more vivid. In particular, some students stated that warm colors such as red, orange, and yellow look much "sweeter" than other colors. For instance, student 18 spoke:

> *Red. I mean, it cheers [me] up. I like the light red very much. I mean, it makes one's eyes open and the like. So, that is why. People would be willing to do so. They understand more and comprehend more; that is why people hate dark colors. The color red stimulates appetite also.*

The same student voiced:

> *Brown comes a little bit dark. Children love bright colors and the like.*

The second most frequent code (f = 15) was the perception of being "Attention Grabbing" of the colors. Students (N = 10) indicated that the use of bright, saturated, and vivid colors in multimedia had the effect of grabbing their attention. For this effect, "catching the eye," "being salient," "hanging out in the eye," "watching out," "focusing," and "being on the focus" are some of the statements referred to by the students. One student voiced:

> *Student 9: Since the colors are catching the eye, since they are attention-grabbing colors, you are not bored. At least, you are focusing only there. You know. [not] to another thing. For example, if the colors were more boring and monotonous, people would be bored if you asked me. I would look elsewhere willy-nilly. But since the colors are attention-grabbing, people inevitably feel they should listen and look at the lesson.*

The third frequent code (f = 6) was the perception of being "Boring" by the gray-scale color scheme. Students (N = 5) thought using gray-scale color was boring and did not look pretty. These students specified that a more colorful approach would be more beautiful and meaningful than the gray-scale scheme since it made them feel bored. In this regard, one student voiced:

> *Student 6: If colorful [scheme] was used… It would not bore me, then. It was like a dark room. I don't know if I am wrong, but I think that way.*

Two students thought using bright, saturated, and attention-grabbing colors acted as a "Facilitating" role for their learning (f = 4). Such colors were helpful to these students because they helped them "remember" and "comprehend" the various parts of the lesson. Colors had an effect of "sticking in mind" and "retrieving the information in the exams." For example, one student said:

> *Student 14: Well, visuals. The purpose is human. Visuals open the human mind. Retrieves [information] during the exam. I mean, If it is colorless, it [information] does not come to my mind personally. Therefore, I use colored pencils for writing in my notebook as well.*

One student had a position of being "Neutral" (f = 1) and specified that bright, saturated, and attention-grabbing colors did not possess any meanings, either positive or negative, for them:

> *Student 17: [Studying with a gray-scale color scheme] did not affect me under any circumstances. It would be the same thing whether it was colorful or colorless.*

Last, one student stated that bright, saturated, and attention-grabbing colors had a "Distractive" effect on their attention (f = 1). Therefore, the gray-scale color scheme was preferable to the colorful one. The student said:

> *Student 25: I would concentrate more on what was being taught if it were colorless. I mean, I would prefer the colorless one.*

Facial Expressions

Since both lifeless objects and humans were used as characters, the category of "Facial Expressions" was divided into "Facial Expression of the Human Characters" and "Expressive Anthropomorphism of the Lifeless Objects."

Facial Expression of Human Characters

Five students specified that using expressive and positive smiling facial expressions for human characters induced "Positive Energy" (f = 5). They believed that the smiling faces used for the human characters made them also smile and be happy. For example, one student commented:

> *Student 13: If they [the character] smile, it is possible that I may smile and have a feeling of being happy towards them as well, but if they do not smile, it is quite colorless. For example, if the facial expressions were bad, it would affect me worse. I watched more and understood more. I do not lean that way if the character is not smiling.*

Some of the students (N = 3) thought that the happy facial expressions used for the human characters were "Interesting" (f = 3). Thanks to these happy facial expressions, these students got more interested in the lesson, which made them watch and listen more. One student stated:

> *Student 19: They approached more cheerfully and looked warmer. [They] behaved warmer. Behaving warmer would attract my interest more. I would listen better. I would try to understand better.*

Some students (N = 2) stated that facial expressions used for human characters were useful for having a "Facilitating" effect on learning (f = 2). Facial expressions, changing in compliance with the characters' actions, helped them understand the lesson. In other words, students thought they established connections between the expressive facial expressions and the characters' actions. For example, one of the students voiced:

> *Student 9: For example, the lifeless object does not do work scientifically when it is taking boxes forward; in that time, their facial expression became sad; we can remember from that. It makes associations. Like lifeless creatures, they [humans] smile when anything happens and become sad when nothing happens. But, they were nice, since they were generally smiling.*

Two students thought that expressive facial expressions used for humans had the effect of being "Attention Grabbing" (f = 2). For example, one student stated:

> *Student 23: For example, The smile of this cook and the like was nice… Because, how can I say, at that time [when he was not smiling], it would not capture my attention. Now it does.*

Expressive Anthropomorphism of the Lifeless Objects

The sub-category "Expressive Anthropomorphism of Lifeless Objects" involved students' views about using humanoid features for lifeless objects. The most frequent code (f = 11) was "Distracting" from using such an approach. Six students thought this approach negatively affected them since they perceived it as distracting. Students stated that their attention was shifted towards expressive anthropomorphism, which was supposed to focus on what was being taught. In other words, students argued that their attention was supposed to be directed toward the essential elements of the lesson, not to the expressive anthropomorphism used for the lifeless objects. In this regard, one student indicated:

> *Student 14: The first time I saw them, they did not capture my interest at all, but then, I started to watch their faces. They captured my attention the second and third times, but at first, they did not capture my attention. I could say that I did not even realize that there were faces. As I listened, I paid attention to the details. They started to distract me.*

Another student commented on their thoughts as follows:

> *Student 6: But how can I concentrate now? Look at the eyes; it seems as if they are looking at me. It got my nerves. It got my nerves on looking at the eyes. Therefore, the other one is better.*

Six students perceived expressive anthropomorphism as "Entertaining" (f = 6). Students believed that the funny faces used for the lifeless objects made the lesson more humorous and entertaining, which would otherwise be otherwise boring and monotonous. These students also added that expressive anthropomorphism helped them learn the subject with fun. In this regard, one of the students expressed their thoughts as follows:

> *Student 9: If my memory serves me right, the first topic was doing work scientifically. When doing work, there was a happy face; when not doing work, there was a sad face. That is, it is like learning by fun.*

Five students found anthropomorphism as "Attention Grabbing" (f = 6). For those students, thanks to anthropomorphism, they could easily give their focus to the lesson since it may prevent them from giving their attention to other things. For example, one student said:

> *Student 4: For example, assuming that if a student watched the lesson without faces like these [anthropomorphism], they would give their attention to other things. But, when there are faces on*

the boxes, it becomes more. It could be focused more on the lesson. That is, it captures attention more.

Five students stated that anthropomorphism had the role of "Facilitating" their learning (f = 6). To these students, the anthropomorphism of the lifeless objects by using expressive facial expressions helped them learn the topic being taught. Students indicated that thanks to the facial expressions, they could establish the connection between the object's facial expressions and what was being taught. For example, one of the students voiced:

> *Student 7: When the ball was released, for example, there was a sad facial expression on the ball's face. I understood from their energies. The facial expressions affect me positively. There was a smiling face when the ball was heightening; while it was lowering, it became a sad face. I was impressed by the energy. It calls to my mind from the facial expression.*

Five students thought that the use of anthropomorphism for lifeless objects was "Redundant / Absurd" (f = 6). These students thought that anthropomorphism did not have any relationship with what was being taught and defined such an approach as being "redundant" and "repelling." For example, students said:

> *Student 24: These are a bit absurd. Is it normal to keep an eye on the car?*

> *Student 11: These are not related to the subject being "taught."*

> *Student 14: Yes. Humans are quite weird, and I hated that truck. [I mean] the transporter truck. The type of it makes me very weird, and these boxes are quite repelling. Because their faces were changing, it was nice, but some of them were really exaggerated. Some of them looked good, and some of them were really exaggerated.*

Five students found the anthropomorphism "Interesting" (f = 5). These students thought it would be more interesting for children to use such approaches in multimedia than ordinary ones. For instance, some of the students commented that:

> *Student 5: For example, they made this alive. They made eyes for this. It would attract children's interest more in this way.*

> *Student 19: Having a face for the lifeless objects is better. Because as I said a while ago, it would capture more interest.*

Four students perceived anthropomorphism as "Appealing/Pleasing." (f=5). These students mentioned the appealing, pleasing, and cheerful effects of anthropomorphism:

> *Student 15: For example, the ball dropped and sank into the sand. Therein, they were smiling at first, and then they became sad faces. They were nice. They were beautiful. That is, it gives pleasure to people; it appeals to people.*

> *Student 7: The smiling forklift and smiling box show us that we understand and become happy. It was pleasing for me, [it was] nice. There were no such approaches in the books.*

Sound Effects

This category involved student opinions regarding contextual sound effects, which were heard while objects moved. In this category, most of the students (N = 8) perceived sound effects as being "Appealing/Pleasing" (f = 9). For example, students said:

> *Student 1: Sound effects look appealing. Look appealing. I mean, it looks nice. It was funny.*

> *Student 3: [Soundless version] bores the people after a particular time as was being watched. It would be better if it included a little bit of sound effects.*

Some of the students (N = 6) thought that sound effects had the negative effect of being "Distracting" (f = 8). They indicated that they experienced difficulties focusing on the audio narration and missed some elements of the instruction because of the sound effects. One student commented:

> *Student 14: When following the sound effects, people are not able to listen [instruction]. I believe that they are distracting attention. I mean, we already know the visuals. They are entertaining, but I feel that I do not understand. I do not understand. I do not know what the others think.*

Some of the students (N = 6) indicated that using sound effects in multimedia was beneficial in that they augmented the "Sense of Reality" (f = 7). More specifically, students thought that sound effects made the animations more realistic by providing a similar means to real life. One of the students commented:

> *Student 2: Sounds have been tried to be simulated. They have been tried to be simulated with the original forms. It approximated the originals; it was nice. For example, when we kick the ball, a sound effect like a crash is heard, and the same sound is heard there, [such as] a rolling sound, clinking sound. A booming sound is heard when dropping, for instance.*

Four students indicated that sound effects were beneficial since they had "Attention-grabbing" effects (f = 5). These students thought that the course captured their attention with the help of sound effects when they were distracted or bored from watching the lesson. For example, one of the students commented:

> *Student 9: It is like colors. When there is a sound effect, when you are bored a little bit, when a sound effect is heard suddenly, your eyes go directly there.*

Three students took a "Neutral" position against using sound effects (f = 4). Students specified that nothing would change for themselves in any usage, either multimedia with sound effects or without sound effects.

> *Student 8: Hmmm, I do not know. Sound effects do not matter to me a lot. Facial expressions and colors are helping me sufficiently. Anyway, we are seeing. It is the same for me, with or without sound effects; it does not matter.*

Lastly, two students found the sound effect "Disturbing" (f = 5). In this regard, one of a the students stated:

> *Student 15: I mean, it is very, both it sounds a lot and, how can I say? It is disturbing. I mean, it is redundant. I found the sound effects redundant.*

Cognitive Aspects of Multimedia Learning

This category involved student opinions addressing the cognitive design elements used in multimedia. The most frequent code was "Interactive Exercises and Questions" (f = 28). This category included student views regarding using interactive exercises, questions, and worked examples in multimedia. Students (N = 18) reflected that using interactive examples, exercises, and worked examples in multimedia instructional materials helped them focus more efficiently on the subject, reinforced what was being taught in the instruction phase, and facilitated their learning. For example, one student commented:

> *Student 20: For example, it gives an example, and after that, there is something of a question under it. For example, if you reinforce them, they actually become nice. Teaching and teaching, for example, and after that, there were questions like "Which of them were doing work scientifically?" They reinforced that they were good.*

The second most repetitive code was "Cognitive Interest" (f = 20). Students (N = 11) reflected that they were not interested in emotional design elements used in multimedia at all. Instead, they stated that the topic captured their attention rather than emotional design and added that they became happy as they learned new things. For instance, one student voiced:

> *Student 10: But they [emotional design elements] do not capture my attention; the lesson captures my attention directly. The colors are interesting, but the lesson itself captures attention more. For example, I am just looking at these [To the important parts]. Is it five kilos or two kilos? Other parts seem uninteresting to me.*

Another student commented:

> *Student 3: Anyway, since the purpose is learning, I do not remark on colors at all. Why was this like that? I am not watching it to say I wish it would be different, but I watch to learn.*

Another code under the category was "Multimedia Principle" (f = 17). Students (N = 12) thought that the use of words along with either static or dynamic visuals was more beneficial than instructional materials that adopted words only. They indicated that they enjoyed using such an approach in multimedia, which facilitated their learning. For example, one student stated:

> *Student 3: For example, if [the audio narration] said that the driving of a car, the acceleration of the car was the kinetic energy just by word, it would not be sufficiently ok. But here [in the instructional software], acceleration of the car or the like was depicted, supported with pictures. It became better.*

"Real-Life Examples" (f = 11) was another cognitive element used. Students (N = 8) expressed their satisfaction concerning the appropriateness of the characters and the related contexts to real life. They also indicated that using real-life examples was helpful, as they easily concretized abstract concepts. For example, one student voiced:

> *Student 22: For example, experiments were conducted on real and simple objects we can find even at home. They were good as well. Additionally, the example of the marble dropping down to the sand taught the gravitational potential energy very well.*

One of the other design issues that were thought to have a cognitive influence on students was coded as "Animations" (f = 7). Students (N = 6) thought supporting what was being taught with animations facilitated their learning. For instance, one student voiced:

> *Student 15: The movement of the humans, the drop of the ball, and the like helped us learn more about the movements.*

The same student stated their view on animations as follows:

> *Student 15: For example, the cars and the like [other objects] were going..That was velocity. It was moving. It was [like] real; for example, the cars were like they were moving. I mean, it became as if it were real. They are facilitating. Then, the apple was dropping from the tree; they were nice.*

Last, the least frequent code was "Signaling" (f = 4). Students (N = 3) specified that they also liked signaling techniques to capture their attention to the most important parts of the instruction.

> *Student 22: For example, with respect to the potential energy topic, with respect to elastic potential energy, for example, it was putting pressure on there. Therein, it was showing (signaling) the force with the arrow. I wish it would be a bit more colorful in the same vein.*

Discussion and Conclusion

The current investigation aimed to obtain insight into the experiences of students who received instruction utilizing different multimedia. The qualitative data analysis indicated that the students possessed both positive and negative feelings regarding emotional design. Results revealed two main categories: "Emotional Aspect of Multimedia Learning" and "Cognitive Aspect of Multimedia Learning."

Concerning color, as expected, students were satisfied with the use of bright, attention-grabbing, and saturated colors, as they indicated that such colors were "appealing," "attention-grabbing," and "facilitating." Some students also believed the black-and-white color scheme was "boring." On the other hand, only one student thought that bright, attention-grabbing, and saturated colors were "distracting." In comparison, one student did not feel anything (neutral) about using such colors in multimedia. From this result, it could be argued that using attention-grabbing colors is helpful. They are related to perceived excitement (Wolfson & Case, 2000), increased attention (Al-Ayash et al., 2016), and memory encoding and retrieval (Shneiderman, 1992; Misanchuk et al., 2000, as cited in Lohr, 2007). Considering Facial Expressions, none of the students had negative feelings about using positive facial expressions for human characters. Students held the idea that "Facial Expressions of Human Characters" were "positively energizing," "interesting," "facilitating," and "attention-grabbing." This finding is consistent with Norman's (2004) list of conditions that induce positive emotions: smiling faces induce positive emotions.

On the other hand, when it comes to "Expressive Anthropomorphism of Lifeless Objects," most students found such an approach "distracting." This finding confirms Brom et al. (2016), who found that those funny anthropomorphic elements may possibly distract learners, while contradicting Park, Knörzer, et al. (2015), who observed that the anthropomorphism captured learners' attention. Shangguan, Gong, et al. (2020) suggest that emotional design might be more distracting for younger students as they have fewer capacities compared to older students. This effect might be more prominent if the prior knowledge is low. Nevertheless, one cannot clearly conclude that students' attention was either captured by the learning content through anthropomorphism or by the anthropomorphism itself. More research is needed to pinpoint the mechanism underlying the attentional effect of anthropomorphism. Concerning anthropomorphism, some students also believed that such an approach was "redundant or absurd." This belief is consistent with the idea that affective design elements could be extraneous and potentially deplete memory resources (Harp & Mayer, 1997, 1998). Other student beliefs about anthropomorphism were positive, indicating that anthropomorphism was "entertaining," "attention-grabbing," "facilitating," and "interesting," which are consistent with the findings of Brom et al. (2016). In sum, as Brom et al. (2016) concluded, anthropomorphic manipulations could affect the state engagement of students since they are funny and entertaining and could act as memory tools facilitating recall. On the other hand, they could be distractive in some cases. Concerning sound effects, the same trend was observed. While most of the students found the sound effects interesting as "appealing or pleasing," increasing the sense of reality or attention-grabbing, some also taught that sound effects were distracting or disturbing, which may be explained by "a trade-off between cognitive distraction and the ability to induce state engagement" (Brom et al., 2016, p. 93).

When students were asked to evaluate their experiences regarding facilitating conditions of learning, students referred to their satisfaction with cognitive design elements used for all conditions, which was categorized as "Cognitive Aspect of Multimedia Learning." Most students said they enjoyed interactive exercises and questions from multimedia materials. The second most repetitive code was Cognitive Interest. The multimedia principle, real-life examples, animations, and signaling were the other elements affecting students' cognition. These cognitive elements were shown to facilitate learning, most related to multimedia learning (Mayer, 2009). Some students indicated that they were cognitively interested in the topic rather than emotional design elements, saying their job was to follow the course content. In other words, these students commented that their happiness was not a result of the emotional design features but rather a result of studying the topic and learning "new things." Based on these results, Kintsch's (1980) distinction between cognitive and affective interest might be reconsidered. Considering these students' situation, as they progress in their learning, they pay greater attention to what they are studying and feel more engaged (Harp & Mayer, 1997). Customizing the learning environment to fit human cognitive mechanisms by minimizing working memory overload can improve learning (Darejeh et al., 2022).

To sum up, the results of the present work are consistent with the idea of a "double-edged sword" metaphor used for affective design elements by Sitzmann and Johnson (2014). On the one hand, our results support the idea that attractive things work better since they may induce positive emotions (Dong, 2007; Norman, 2004). On the other hand, they may also pose a danger to learning since they could be perceived as "Distracting," "Disturbing," or "Redundant." More research is needed to clarify under which conditions affective design elements are perceived as helpful or useless. Additionally, instructional designers should carefully use affective design elements for multimedia materials. Designers of educational materials should work first and foremost to stimulate students' cognitive interest. Emotional interest should be considered afterward. They should consider the potential benefits and pitfalls of such emotionally designed elements (Clark & Lyons, 2010). Given that the students have different views on using emotional design elements, personalized multimedia learning environments adopting choice-based emotional elements could be utilized to address students' needs.

Our study undoubtedly has some limitations. First, one limitation lies in the fact that students' views on the use of different emotional design elements were not linked to their learning achievement. Hence, the results should be evaluated within this boundary condition. Second, the study was conducted with a specific student group (seventh-grade students) addressing only one study topic (Work, Energy, and Energy Conservation), so more future research is needed in different context.

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Genişletilmiş Türkçe Özet

Çoklu ortam öğretim materyallerini daha ilgi çekici hale getirme çabaları alan yazında her zaman tartışmalara konu olmuştur. Geçmişte yapılan ve Çoklu Ortamla Öğrenmenin Bilişsel Kuramını (ÇOÖBK) (Mayer, 2009) temel alan çalışmalar ilginç ama öğrenme kazanımlarıyla doğrudan ilgili olmayan tasarım unsurlarının öğrenmeyi olumsuz bir şekilde etkilediğini ortaya koymuştur. Bunun nedenlerinden biri olarak da bu tasarım unsurlarının çalışan bellek kapasitesi üzerindeki yükü artırması görülmüştür (Harp & Mayer, 1997,1998). Öte yandan, araştırmacılar bu tasarım unsurlarının öğrenmeye zarar verme riskinin olmasına rağmen motivasyonel faydalarının yadsınamayacağını belirtmişlerdir (Harp & Mayer, 1998; Park, Flowerday, vd., 2015). Bu görüşten hareketle, geleneksel katı bilişsel yaklaşımların duygusal ve motivasyonel değişkenler bağlamında yeniden değerlendirilmesi gerektiği ifade edilmiştir. Buna bağlı olarak, son yıllarda Moreno (2006) "Medya ile Öğrenmenin Bilişsel-Duyuşsal Kuramını" (MÖBDK), Plass ve Kaplan (2016) "Çoklu Ortamla Öğrenmenin Bütünleşik Bilişsel-Duyuşsal Modelini" (ÇOÖBBDM) ve Mayer (2020) "E-Öğrenmenin Bilişsel-Duyuşsal Modelini" (EBDM) önermişlerdir.

Bu kuramlarlar doğrultusunda, son zamanlarda çoklu ortam öğrenmede duygusal tasarım unsurlarının kullanılması, yeni bir yöntem olarak karşımıza çıkmaktadır (Heidig vd., 2015; Liew vd., 2022; Plass vd., 2014; Um vd., 2012; Wang vd., 2023). Duygusal tasarım yaklaşımı, ilginç fakat öğrenme kazanımları ile doğrudan ilgili olmayan çekici tasarım unsurlarını kullanmak yerine olumlu duyguları artırmak ve öğrenmeyi teşvik etmek için, fazladan detaylara yer vermeden tasarım unsurlarının görünüşlerini asgari düzeyde değiştirmeyi amaçlamaktadır (Heidig vd., 2015; Zhao ve Mayer, 2023). Alan yazında, en sık kullanılan tasarım teknikleri tasarım elemanları için dikkat çekici, parlak renklerin kullanılması ve cansız varlıklara bebeksi insan yüzlerinin (antropomorfizm) atfedilmesidir. Duygusal tasarım yaklaşımı son yıllarda popüler olsa da, alan yazında bu yöntemin kullanıldığı çalışmalarda farklı sonuçlar elde edilmiştir (Brom vd., 2018; Stárková vd., 2019).

Alan yazında konu ile ilgili yapılan ilk çalışmalar yöntemin öğrenme başarısını etkilemesi bakımından üstünlüğünü ortaya koymuştur (Mayer ve Estrella, 2014; Plass vd., 2014; Um vd., 2012). Park, Knörzer, vd. (2015) insanbiçimciliğin (antropomorfizm) dikkat çekici gücünü göz izleme yöntemi ile ortaya koymuştur. Brom vd. (2016) insan biçimciliğin öğrenme bakımından yüzeysel bir etkiye sahip olduğunu göstermiştir. Stárková vd. (2019) insan biçimciliğin öğrenme üzerinde etkisinin olduğunu bulmuş, bu yaklaşımın dikkat üzerinde ise sınırlı bir etkisinin olduğunu göstermiştir. Son zamanlarda yapılan çalışmalarda ise Slabbert vd. (2022) duygusal tasarım yaklaşımının öğrenme üzerinde bir etkisinin olmadığını gösterirken, Wang vd. (2023) duygusal tasarımın öğrenme başarısından transfer puanı üzerinde etkili olduğunu göstermiştir.

Duygusal tasarım konusu ile ilgili yapılan çalışmaların farklı sonuçlar ürettiği görülmekle birlikte bu konuda yapılan çalışmaların halen devam ettiği görülmektedir. Bu konuda yapılan çalışmaların büyük bir bölümünün de nicel çalışmalardan oluştuğu söylenebilir. Bu anlamda, bu çalışmada farklı duygusal yaklaşıma göre hazırlanan öğretim

materyallerini kullanan öğrencilerin bu materyaller ile ilgili görüşleri nitel araştırma yöntemi ile incelenmiştir. Bu amaçla, içerik bakımından tamamen birbirinin aynı fakat ele aldığı tasarım yaklaşımı bakımından farklı olan dört öğretim materyali geliştirilmiştir. İlk materyalde, yansız yaklaşım benimsenmiş olup siyah beyaz renk düzeni kullanılmıştır. İkinci materyalde, siyah beyaz renk düzeni yerine ilgi çekici ve parlak renkler kullanılmıştır. Üçüncü materyalde ilgi çekici renk düzeninin yanında insan biçimcilik yaklaşımı ile cansız varlıklara insansı özellikler yüklenerek yüz ifadelerinin pozitif bir hale bürünmesi sağlanmış, canlı varlıklar içinse gülen yüz ifadelerinin kullanılması sağlanmıştır. Son materyalde, bütün bu tasarım yaklaşımlarına ek olarak canlı ve cansız varlıklar için çizgi filmsel ses efektlerinin kullanılması yaklaşımı benimsenmiştir.

Oluşturtulan materyaller bir devlet okulunda okumakta olan ortaokul 7.sınıf öğrencileri tarafından kullanılmıştır. Bu materyaller, tüm sınıflar arasından seçkisiz olarak seçilen dört sınıf grubuna yine seçkisiz olarak atanmıştır. Öğrenciler, "Kuvvet, İş, Enerji ve Enerji Korunumu" konusunu ele alan bu materyalleri müfredat kapsamında üç hafta boyunca kullanarak dersi işlemişlerdir. Süreç sonunda öğrencilerin farklı duygusal tasarım yaklaşımları ile ilgili algıları incelenmiştir. Bu amaçla, her sınıftan maksimum çeşitlilik örnekleme yöntemine göre seçilen toplam 28 öğrenci ile yüz yüze görüşmeler yapılmıştır. Görüşme yöntemine göre toplanan veriler içerik analizi kullanılarak analiz edilmiştir. Ayrıca verilerin bir bölümü başka bir araştırmacı tarafından incelenmiş olup kodlayıcılar arası güvenirlik değeri hesaplanmış ve bu değer istenilen düzeyde bulunmuştur (0.85).

İçerik analizi sonucuna göre kodlar "Çoklu Ortamla Öğrenmenin Duyuşsal Boyutu" ve "Çoklu Ortamla Öğrenmenin Bilişsel Boyutu" olmak üzere iki temel kategori altında toplanmıştır. Çoklu Ortamla Öğrenmenin Duyuşsal Boyutunda "dikkat çekici renkler", "yüz ifadeleri (antropomorfizm)" ve "ses efektleri" alt temaları bulunmaktadır. Öğrencilerin bu tasarım unsurları ile ilgili hem olumlu hem de olumsuz görüşlerinin olduğu görülmüştür. Örneğin bazı öğrenciler ilgi çekici renklerin "çekici/hoşa giden" ve "ilgi çekici" olduğunu düşünürken bazı öğrenciler de bu renklerin "sıkıcı" olduğunu belirtmiştir. Cansız varlıklar için kullanılan yüz ifadeleri için genel olarak "dikkat dağıtıcı" ve "eğlenceli" kodları görülürken, insanlar için kullanılan pozitif yüz ifadelerinin "pozitif enerji" verici ve "ilginç" kodları görülmüştür. Ses kategorisinde ise en çok tekrar eden kod "çekici/hoşa giden" olmuştur. Bazı öğrenciler ise ses efektlerinin "dikkat dağıtıcı" olduğunu düşünmektedir.

"Çoklu Ortamla Öğrenmenin Bilişsel Boyutu" adlı kategoride öğretim materyallerinde kullanılan ve tüm öğretim materyallerinde ortak olan bilişsel tasarım unsurlarına ilişkin öğrenci görüşleri yer almıştır. Öğrencilerin öğretim materyallerinde öğrenmelerini kolaylaştıran ya da zorlaştıran unsurlar sorulmuştur. Elde edilen cevaplar da bu kategoride toplanmıştır. Bilişsel unsurlar arasında etkileşimli alıştırmalar ve sorular, çoklu ortam ilkesi, bilişsel ilgi, gerçek hayattan örnekler, animasyon kullanımı ve dikkat çekme ilkesi gibi kodlar yer almaktadır.

Sonuçlar bir bütün olarak incelendiğinde, ilgi çekici unsurların çoklu ortamda kullanılmasının Sitzmann ve Johnson (2014) tarafından kullanılan "iki ucu keskin kılıç" metaforu ile uyumlu olduğu görülmektedir. İlgi çekici unsurlar bir yandan pozitif duyguyu

artırıp öğrenmeyi olumlu etkileme potansiyeline sahipken diğer yandan bu unsurların kullanılması bazı öğrenciler tarafından "dikkati dağıtıcı" "rahatsız edici" ve "gereksiz olarak değerlendirilmiştir. Bu konuda daha fazla nitel araştırmanın yapılması, bu unsurların hangi durumlarda daha kullanışlı ve kullanışsız olduğunu ortaya koyabilir. Ancak unutulmamalıdır ki etkili bir öğrenmenin olabilmesi için öğretim tasarımcılarının duygusal ilgiden önce bilişsel ilgiyi temin etmesi gerekmektedir. Tasarımcıların bilişsel unsurları yerinde kullandıktan sonra bilişsel yük oluşturmadan duygusal tasarım unsurlarını kullanması gerekmektedir. Öğrencilerin duygusal tasarım unsurları hakkında farklı görüşe sahip olması göz önünde bulundurulduğunda, farklı isteklere sahip öğrenenler için farklı duygusal tasarım yaklaşımlarının kullanılmasına olanak sağlayan seçenek temelli, uyarlanabilir çoklu ortam öğretim materyalleri kullanılabileceği söylenebilir.

Authors	Contact
Ahmer Murat Uzun	Afyon Kocatepe, University, Turkey. E-mail: auzun@aku.edu.tr.
Zahide Yıldırım	Middle East Technical University, Turkey. E-mail: zahidey@metu.edu.tr.