Comparing Design Features of Educational Agents: Student Perspectives

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Article Info	Abstract
	Educational agents are virtual characters that guide students in digital learning environments, transfer knowledge, and support the learning process, enhancing human-computer interaction. With the integration of AI-supported systems into education, the use of educational agents is becoming increasingly widespread. Educational agents with human-like characteristics are said to positively impact students' learning by creating environments that resemble human-human interaction, enhancing social interaction. This study examines the views of learners interacting with educational environments that utilize different types of educational agents (animated, static, and voice-only) with distinct design features. The data was collected qualitatively through semi-structured interviews from students. The findings were analyzed in relation to themes such as voice use, agent appearance, learning process, interaction, and motivation. This research highlights the role of educational agents, student-agent interaction, and the effect of voice, mobility, gestures, and facial expressions on the learning process within the context of students' experiences and perspectives. In this context, it is considered important for future research in the field of educational technology.

Introduction

With the integration of technology into educational processes, it has become possible to design interactive and personalized learning experiences in digital learning environments. Providing support tailored to students' needs, especially in web-based learning environments, is considered more important today than ever before (Terzidou et al., 2016; Tao et al., 2022; Sikström et al., 2022). In this context, the integration of artificial intelligence-supported systems into educational processes makes the learning process more effective and efficient; the use of educational agents among these systems is also becoming increasingly widespread. Educational agents are virtual characters that guide students in digital environments, transfer knowledge, assist by directing attention, and provide interactive learning environments (Johnson et al., 2000; Choi & Clark, 2006; Heidig & Clarebout, 2011; Schneider et al., 2022; Davis et al., 2023). Educational agents are designed to create high levels of face-to-face learning interaction in digital learning environments (Johnson & Lester, 2016; Davis et al., 2023); assist students in the learning process (Carlotto & Jaques, 2016), guide students (van der Meij et al., 2015; Schneider et al., 2022); simulate conversations and nonverbal behaviors (Liew & Tan, 2016; Davis, 2018), support student learning (Lane, 2016; Schroeder, 2017; Petersen et al., 2021), and support student and teacher roles (Terzidou & Tsiatsos, 2014).

Educational agents, especially those that are conversational and virtual companions, have become increasingly important in learning environments as an innovative technology that enhances learning performance. Particularly in recent days, when human-computer interaction and artificial intelligence are on the agenda, agents are taking on the roles of teachers and creating opportunities for personalized and engaging learning experiences. Educational agents can enhance the social aspects of multimedia learning environments, enabling students to pay more attention to learning materials and engage more actively (Mayer et al., 2003; Atkinson et al., 2005; Mayer & DaPra, 2012).

It is important to be able to create social interaction in learning environments. Educational agents are educational technology applications that have the potential to develop social relationships in the context of human-computer interaction by creating an interactive environment in digital learning environments (Moreno et al., 2001) and increase students' engagement in the learning process (Mayer et al., 2003). When students perceive their interactions with computer-based characters as similar to their interactions with humans, they view this as real social interaction (Reeves & Nass, 1996; Mayer et al., 2003; Atkinson et al., 2005; Davis et al., 2023).

An educational agent with human-like gestures, gaze, facial expressions, and movements can trigger social processes in the learning environment, enabling students to experience more realistic communication. This leads them to make more effort to understand the agent's expressions, resulting in deeper cognitive processing (Atkinson, 2002; Mayer et al., 2003; Krämer & Bente, 2010; Mayer & DaPra, 2012; Stull et al., 2021; Schneider et al., 2022). Various studies have shown that when educational agents display animated gestures or facial expressions, students' learning performance increases as their connection with the agent increases (Baylor & Kim, 2009; Davis, 2018; Wang et al., 2018; Liew et al., 2022). Evidence has been found in the literature that the design of educational agents can influence learning performance and students' perceptions (Veletsianos, 2007; Domagk, 2010; Kim & Wei, 2011; Ozogul et al., 2011; Johnson et al., 2013; Krämer et al., 2016; Adamo-Villani & Dib, 2016; Liew et al., 2017; Lippert et al., 2020; Li et al., 2022; Bian & Zhou, 2022; Schneider et al., 2022; Wang et al., 2022; Davis et al., 2023). When considering educational agents designed with different design types, it is seen that they directly affect variables such as students' attention levels, the way they interact with the agent, and their participation in the learning process (Wang et al., 2018; Li et al., 2022).

Reviewing the literature, it is evident that educational agents are expected to possess diverse characteristics to support effective learning. However, studies addressing different design types of educational agents are limited. This study aims to examine the views of learners interacting with an educational environment that utilizes educational agents designed with different design characteristics. In this context, a deep qualitative study was needed about how student views different types of educational agents, namely animated agents, static agents, and voice agents. In line with these objectives, the study seeks to answer the following question: What are students' opinions of educational agents with different design features, specifically animated, static, and voice agents?

Method

In this study, a case study design, as a qualitative research approach, was utilized. A case study facilitates the

detailed and in-depth examination of a particular phenomenon within its real-life context (Yin, 2018). This method enables researchers to explore the multifaceted effects of the developed material on students.

Study Group

The research group consisted of teacher candidates enrolled in English Language Teaching, Social Studies Teaching, and Special Education Teaching programs at a university in Turkey during the fall semester of the 2024-2025 academic year. The research was conducted as part of the Information Technology course. Out of 174 students enrolled in the course, 162 participated in the study. Within the scope of the research, three groups were formed based on the design of educational agents: animated, static, and voice-only. Students were randomly assigned to one of these groups to ensure balance among them at the outset. In this study, interviews were conducted with a total of 60 participants, with 20 randomly selected students from each agent group.

The Research Implementation Process

The teaching process within the scope of the research was planned based on the flipped learning model. This model involves presenting traditional lectures online using videos or digital educational materials and allocating the classroom learning process to interactive activities such as application, discussion, and problem solving (Bergmann & Sams; 2012). The in-class and online learning activities were designed based on the topics covered in the course and lasted for 8 weeks. In-class activities were conducted in a computer lab, while the online learning process was carried out using the Moodle learning management system.

The multimedia learning materials uploaded to the learning management system were designed to include the same topics and interactions for all groups. Each material lasts approximately 9-10 minutes, and the total duration of the 8-week program is approximately 1 hour and 7 minutes. The multimedia learning materials prepared included different types of educational agents. Three educational agents were prepared for three groups: the animated educational agent group, the static educational agent group, and the voice educational agent group.

The learning material supported by an animated agent presents the subject matter through an educational agent that features animation, movement, gestures, facial expressions, and movements. The agent has a human-like appearance and is supported by animations such as facial expressions and hand and arm movements. Throughout the subject presentation, the agent actively moves, accompanies the presentation with gestures and facial expressions, and provides voice narration at the same time. In the background, there are texts, icons, and screen images related to the subject headings.

In learning materials supported by a static agent, the agent appears on the screen as a static image. During the explanation of the topic on the screen, the agent's image is static and does not contain any movement or animation, but is accompanied by voice narration. Learning materials supported by voice agents consist solely of voice narration. There are no agent visuals or characters on the screen. Information is provided to users solely through voice guidance, accompanied by screen text or visuals. Screen shots of materials featuring animated educational

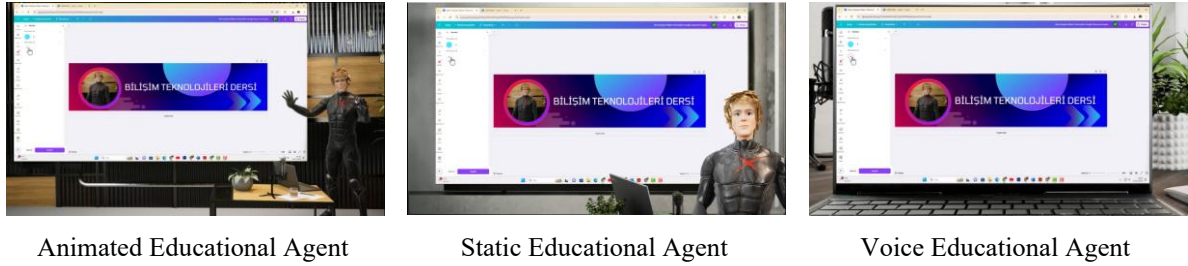agents, static educational agents, and voice agents are shown in Figure 1.

| Animated Educational Agent | Static Educational Agent | Voice Educational Agent |

Figure 1. Screen Shots of Animated, Static, and Voice Educational Agent Materials

Data Collection Tool

A semi-structured interview form was prepared to examine participants' views on educational agent types. In this context, a semi-structured interview form consisting of 16 open-ended questions was created to obtain the views of students who interact with educational agents, drawing on the literature. To reveal students' experiences with educational agents in a multidimensional way, questions such as the agent's contribution to the learning process, appearance, gender, mobility, feedback, and interaction level were customized for each agent type group. The prepared questions were submitted to expert opinion, and the researchers finalized the questions.

Data Collection and Analysis

The research data was obtained through face-to-face interviews with students at the end of the application. Interviews were conducted with 20 randomly selected individuals from each agent group. The questions on the interview form were approved, directed to the students, and recorded. At the end of the interviews, all audio recordings were listened to individually and converted into Excel files. The data obtained were organized by the researcher, meaningful statements were identified after detailed examination, and coding was performed taking into account the relevant literature. In the process of creating themes, previous scientific studies on educational agents were used as a guide, and the themes of "Use of Voice, Agent Appearance, and Motivation" were structured accordingly. Additionally, the themes "Learning Process" and "Interaction" emerged from the students' views. Expressions reflecting similar thoughts among participants were coded, and these codes were then grouped based on their content-related similarities to form new themes. The process following the establishment of the code and theme structure was conducted using MAXQDA 2024 software. Codes were grouped under overarching themes based on their content-related relationships and recurring patterns.

Findings

This section of the study presents findings derived from data analysis. Students' views on the educational agent in the animated and static agent groups were categorized in five main themes: 'Use of Voice, Agent Appearance, Learning Process, Interaction, and Motivation'. Since the same voice is used across all groups, the Use of Voice theme was evaluated as common to all. Conversely as the voice-only agent group lacks a visual representation,

the Agent Appearance theme was analysed exclusively for the animated and static agent groups. In the voice-only agent group, four main themes were identified. All themes and their associated code categories, as reported by the students, are illustrated in Figure 2. The findings related to the themes in each group are presented in detail in the following sections.
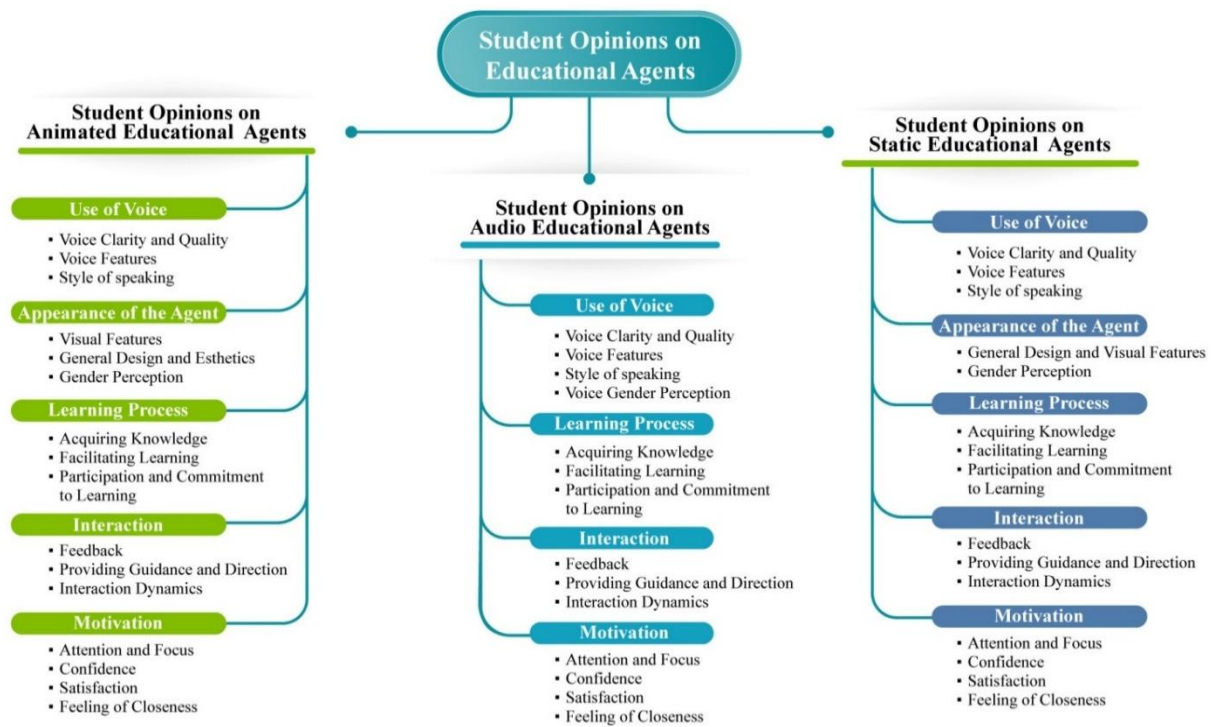
Figure 2. Themes and Code Categories Obtained from Student Opinions on the Educational Agent

Students' Opinions on the Animated Educational Agent

This section analyses qualitative data reflecting students' views on the animated educational agent. The findings obtained from the analysis were grouped under five main themes: *'Use of Voice, Appearance of the Agent, Learning Process, Interaction, and Motivation'*. Figure 1 shows the main themes and code categories.

Use of Voice

Students' opinions on voice usage were examined and categorized into three categories: *'Voice Clarity and Quality', 'Voice Features'*, and *'Style of speaking'*. The code categories and codes are presented in Table 1.

Table 1. Code Categories and Codes for the Use of Voice in Animated Educational Agents

Main Theme	Code Category	Codes	f	Students
Use of Voice	*Voice Clarity and Quality*	Voice clarity	5	h3, h4, h5, h16, h20
		Intelligibility	10	h3, h4, h5, h6, h7, h9, h10, h13, h17, h18
		Speech rate	7	h2, h3, h4, h5, h6, h13, h14

Main Theme	Code Category	Codes	f	Students
	Voice Features	Intonation	10	h1, h4, h5, h7, h8, h10, h16, h17, h18, h19
		Voice level	4	h1, h9, h5, h15
		Emphasis	5	h2, h3, h9, h8, h10
	Style of speaking	Robotic/natural voice	5	h13, h14, h15, h16, h20
		Sincerity/formality	8	h3, h6, h10, h11, h13, h15, h17, h19

Five of the students interviewed found the agent's voice very clear. Students who commented on the clarity of the agent's voice (n=10) stated that the voice was clear. Students also expressed their opinions on the agent's speaking speed; four students stated that the agent spoke too fast, while three students found the speaking speed slow.

> *"Clear and concise, explained which menu was useful, which was helpful for my work. (H4)"*
> *"Innovative, which is very good, but speaks a little slowly and could speed up. (H2)"*
> *"The presentation could have been a little slower. It was a little fast. (H13)"*

Students expressed their opinions on the animated agent's tone of voice, volume, and emphasis. Ten students described the agent's tone of voice as impressive, beautiful, and/or lively, while four students emphasized that the agent raised and lowered his voice at times and changed it in some places during the narration. Five students specifically mentioned that the agent emphasized key points of the topic, and that these sudden emphases caught their attention.

> *"He had an impressive tone of voice. (H7)"*
> *"The agent raised his voice in some places and lowered it in others. I liked that. (H9)"*
> *"He emphasized important points with his voice, which helped us understand the topic better. (H8)"*

Thirteen of the students interviewed expressed their opinions about the agent's style. Students who found the agent's speech robotic stated that this reduced the level of sincerity. Students who found the voice natural and human emphasized that they found this style friendlier and sincere.

> *"When you talk like a robot, it lacks sincerity. He couldn't do that very well. (H13)"*
> *"Nextron's (name of agent) human-like speech was impressive. (H16)"*
> *"I can give the example of his sincere tone of voice. That also had a positive effect. (H15)"*

Appearance of the Agent

Students' views on the appearance of educational agents were examined under three categories: *'Visual Features', 'General Design and Esthetics',* and *'Gender Perception'*. The code categories and codes are presented in Table 2.

Table 2. Code Categories and Codes for the Appearance of the Agent in Animated Educational Agents

Main Theme	Code Category	Codes	f	Students
Appearance of the Agent	*Visual Features*	Liveliness / Movement	20	h1, h2, h3, h4, h5, h6, h7, h8, h9, h10, h11, h12, h13, h14, h15, h16, h17, h18, h19, h20
		Facial Expressions	17	h1, h3, h5, h6, h7, h8, h9, h10, h11, h12, h14, h15, h16, h17, h18, h19, h20
	General Design and Esthetics	Perception of Realism	18	h1, h2, h3, h4, h5, h6, h7, h8, h9, h11, h12, h13, h14, h16, h17, h18, h19, h20
		Overall Appearance	15	h2, h3, h4, h5, h6, h7, h9, h10, h12, h13, h14, h15, h17, h18, h20
	Gender Perception	Not Important	12	h1, h2, h3, h4, h6, h9, h10, h11, h12, h13, h16, h17
		Preference	5	h5, h14, h7, h8, h15

All students in the animated agent group emphasized the contribution of the agent's mobility to their learning. Students stated that the agent's movements attracted their attention and aroused surprise and admiration by creating a sense of a real human presence, that they were able to focus on the subject thanks to the agent's lively movements, and that they actively participated in the process by perceiving the agent as "human-like." They also suggested that the agent should not only move its hands, but also perform more holistic movements such as walking. Seventeen students reported positive views on the agent's facial expressions and use of gestures. They stated that the agent's ability to switch between happiness and seriousness and its natural facial expressions, such as blinking and smiling, created the feeling of being in a class with a "normal teacher." Some students emphasized that the facial expressions were artificial or limited, but overall, the students determined that the gestures and facial expressions supported the flow of the lesson.

> *"He can be happy. He can teach the lesson normally and seriously when necessary. He can squint his eyes and smile. ... I felt like he was a normal teacher. I liked him. His facial expressions were good. He can make every expression. Just like normal people. (H1)"*
>
> *"His movements caught my attention... I was very surprised when I realized that he was a real person and that he was bringing the character to life. I liked that he was human. (H5)"*
>
> *"Since it's an animated character, it felt a bit fake to me... The gestures and facial expressions didn't make it feel very human. (H14)"*

Students (n=18) who commented on the educational agent's sense of realism stated that the agent's human appearance created a completely realistic "human feel" and distanced it from a robotic structure. Other students, however, stated that the agent looked too digital, which reduced its appeal. Students who commented on the agent's overall appearance (N=15) expressed their opinions on the agent's costume and color choices. While they generally found the black color appropriate, they stated that using lighter and more eye-catching colors would increase visual appeal. Among those who criticized the outfit, some found it to resemble a superhero style and stated that this made it difficult to take the character seriously. On the other hand, it was suggested that the agent's

doll-like form created a puppet-like feel and that a more human and natural costume design would increase credibility.

> *"The top was black, it could have been a lighter and more eye-catching color, but it was still fine. (H2)"*
> *"It felt like there was a person in front of me. It wasn't like a robot; it was like a human being. (H4)"*
> *"It looked a bit like a superhero. Like Marvel's Iron Man. So, I couldn't take it very seriously. (H14)"*
> *"It looks like a toy doll. It could have been more human-like. (H17)"*

Of the students interviewed about gender, 12 emphasized that the gender of the agent was unimportant, while 5 students stated that gender was important to them and indicated their preferences.

> *"Gender doesn't matter to me. An impressive tone of voice, gestures, and facial expressions helped me pay more attention to the topic. (H1)"*
> *"I think men are better at explaining things. (H5)"*
> *"If I had a choice, I would prefer a woman. (H7)"*

Learning Process

Student opinions on the contribution of animated educational agents to the learning process were examined and discussed under three categories: *'Acquiring Knowledge', 'Facilitating Learning',* and *'Participation and Commitment to Learning'* as presented in Table 3.

Table 3. Code Categories and Codes for the Learning Process in Animated Educational Agents

Main Theme	Code Category	Codes	f	Students
Learning Process	*Acquiring Knowledge*	Explanatory narration	17	h1, h2, h3, h4, h5, h7, h8 h9, h11, h12, h13, h14, h15, h16, h17, h19, h20
		Expertise	16	h1, h2, h3, h4, h5, h6, h7, h8, h9, h11, h12, h15, h16, h18: h19, h20
		Teaching	7	h3, h9, h10, h12, h16, h19, h20
	Facilitating Learning	Learning Support	16	h1, h2, h3, h4, h5, h6, h8, h9, h11, h12, h13, h14, h15, h16, h17, h18
		Contributing to the Application	18	h1, h2, h3, h5, h4, h6, h7, h9, h10, h11, h12, h14, h15, h16, h17, h18, h19, h20
	Participation and Commitment to Learning	Participation in the Process	13	h5, h6, h7, h8, h9, h10, h13, h14, h15, h16, h17, h18, h20
		Agent Incentives and Entertainment	19	h1, h2, h4, h5, h6, h7, h8, h9, h10, h11, h12, h13, h14, h15, h16, h17, h18, h19, h20

Almost all of the students interviewed in the animated agent group emphasized the agent's narration and expertise.

They stated that the agent's narration was good, that he focused on the necessary details, and that he explained the topics in a simple, clear, and step-by-step manner. Sixteen students expressed the agent's expertise in terms of their mastery of the subject and the provision of sufficient information, while seven students evaluated the agent's educational approach, stating that they were able to learn through the agent's ability to not only provide information but also make the topics meaningful and through practical explanations.

"So, he explained the topic by showing it. He provided basic information. (H2)"

"He was able to explain everything in detail. That's how I understood it. (H1)"

"The agent helped me learn the topics in a simpler, concise, and clear way. Thanks to his practical explanations, I was able to do it myself. I learned. (H20)"

In terms of facilitating learning, 16 students stated that the agent provided learning support, emphasizing its movements in particular. They stated that the agent facilitated the learning process, was helpful, and provided support through his movements. Almost all of the students stated that the educational agent contributed to their learning processes. They stated that the agent's visual guidance through hand and arm signals and gestures and facial expressions, verbal guidance, and explanations actively contributed to their learning processes.

"Nextron made our work easier by giving instructions, explaining, and demonstrating. (H16)"

"He was helping me like a real friend. He was showing me where to click with gestures. (H4)"

"His guidance was the most helpful. When I clicked, he would point to certain places with his hand. He kept it lively. He was there in the moment. (H19)"

In the Participation and Commitment to Learning category, the point most emphasized by students was that the agent was fun. Nineteen students agreed that the agent's humorous approach encouraged them to participate in the lesson. Thirteen students stated that they were actively involved in the learning process thanks to the educational agent. Students stated that the main elements that increased their participation in the process were the agent's words and movements and his style of narration.

"He encouraged us to participate in the lesson interactively by saying things like 'you're great, keep going, click on this point' using various expressions. (H20)"

"It was very useful for me that he was so animated, beautiful, and instructive, especially when he prepared 'click' or questions and asked me. And it increased my interest in the lesson. (H18)"

"He explained better, faster, more superficially, and more concisely, which made me more engaged. (H14)"

Interaction

Student opinions regarding the interaction between animated educational agents and students were examined under three categories: *'Feedback', 'Providing Guidance and Direction', and 'Interaction Dynamics'.* The code categories and codes are presented in Table 4.

Table 4. Code Categories and Codes for the Interaction in Animated Educational Agents

Main Theme	Code Category	Codes	f	Students
Interaction	*Feedback*	Informative Feedback	6	h3, h6, h9, h11, h15, h20
		Affirmative Feedback	5	h1, h7, h14, h16, h4
		Negative Feedback	3	h2, h8, h10
	Providing Guidance and Direction	Explanatory Guidance	10	h4, h6, h11, h12, h13, h14, h17, h18, h19, h20
		Visual Guidance	9	h1, h4, h5, h9, h10, h12, h14, h15, h18
		Verbal Guidance	7	h1, h9, h10, h11, h12, h16, h17
	Interaction Dynamics	Student-Agent Interaction	11	h3, h4, h6, h7, h10, h11, h15, h17, h18, h19, h20
		Assessment and Expectations	9	h2, h7, h8, h10, h12, h13, h16, h17, h18
		Activity	8	h1, h4, h8, h9, h15, h16, h18, h19

Six of the students interviewed stated that the feedback provided by the animated educational agent was informative, while five stated that it was encouraging. The students found the informative feedback provided by the educational agent after the interactions motivating and said that it reduced their anxiety about making mistakes. The agent motivated and informed the students with explanations when they made mistakes. The students stated that the affirming feedback provided by the agent, such as "Correct!" and "Great!", increased their active participation and motivation in the lesson. They also stated that they felt like friends due to the human-like interactions. Three students interviewed expressed negative opinions about the feedback. They stated that the feedback provided on the online platform did not ensure sincerity and motivation in the interaction and that they found the agent's statements artificial, coercive, and unrealistic.

"It didn't affect feedback like normal traditional face-to-face education because we couldn't get motivated on an online platform. (H2)"

"I don't think it was very sincere in terms of feedback. Those sentences seemed a bit forced. (H8)"

"Feedback like 'Right! Great! Congratulations! You couldn't do it, but don't be sad!' motivated us and kept us active, I think. The feedback was human. It was like a friend, so sweet… (H16)"

Half of the students interviewed emphasized the agent's explanatory guidance. They stated that the agent's step-by-step verbal instructions guided them as if they were a teacher, structuring the learning process, and emphasized their satisfaction. Students who emphasized the agent's visual instructions, such as hand movements and colored markings (n=9), mentioned that this made it much easier to follow the application steps. They emphasized that the agent's clear indication of where to click on small or easily overlooked areas of the screen helped them focus. Students said that these visual instructions enabled them to establish instant, visual-based interaction with the agent and actively participate in the process. Students who also emphasized the agent's verbal instructions (n=7) stated that the agent provided a sincere teacher-student interaction by constantly talking and using gestures and

facial expressions; that these instructions accompanied the application process and supported their focus and participation in the lesson.

> *"The instructions he gave with his hands actually made the process easier. He pointed out details that I couldn't see or that were too small on the screen, directing my attention to them. (H9)"*
> *"He explained and showed me with his movements. I was already looking there anyway. I was doing it while looking directly at him. (H12)"*

Students in the animated educational agent group who expressed their opinions in the context of student-agent interaction (n=11) stated that the agent's talking provided a learning process similar to teacher-student interaction and created a sense of mutual and continuous interaction with the agent. Nine students indicated that they expected the agent to provide real-time question-and-answer and instant feedback during the learning process to ensure mutual interaction. A group of students (n=8) stated that thanks to the agent's guidance, they were able to move from being mere observers to actively participating in applications, and that this participation improved their skills and made their learning more permanent.

> *"I would really like him to be able to answer my questions. It would be great to get instant feedback and responses... (H2)"*
> *"I started using applications I couldn't use before. I got better with practice. Nextron explained the topic there. We applied it in class. We did the homework... (H8)"*

Motivation

Student opinions on the effect of animated educational agents on student motivation were examined and discussed under four categories: *'Attention and Focus', 'Confidence', 'Satisfaction',* and *'Feeling of Closeness'*. The code categories and codes are presented in Table 5.

Table 5. Code Categories and Codes for the Motivation in Animated Educational Agents

Main Theme	Code Category	Codes	f	Students
Motivation	*Attention and Focus*	Focus	10	h9, h10, h11, h12, h13, h14, h15, h16, h17, h18
		Attention and Retention	14	h1, h2, h3, h4, h5, h6, h9, h10, h11, h12, h15, h18, h19, h20
		Interest	8	h5, h6, h7, h8, h9, h15, h18, h20
	Confidence	Trust in the Agent	8	h5, h6, h8, h11, h13, h17, h18, h20
		Self-Confidence	5	h2, h6, h7, h11, h16
	Satisfaction	Enjoyment of the Process	15	h2, h3, h5, h6, h8, h9, h10, h11, h13, h14, h15, h16, h17, h19, h20
		Efficiency	5	h7, h8, h9, h16, h18
	Feeling of	Social Relationship	17	h1, h2, h3, h4, h5, h6, h7, h8, h9, h10, h11, h12,

Main Theme	Code Category	Codes	f	Students
	Closeness	Building		h14, h15, h16, h17, h20
		Emotional Bond and Sincerity	15	h1, h2, h4, h6, h7, h8, h9, h11, h13, h14, h15, h16, h17, h18, h20

In the Attention and Focus code category, ten students reported on focus and eight on interest. Students mentioned that the agent's appropriate pauses, gestures, and facial expressions contributed to their focus. They stated that the agent's question-and-answer-oriented interaction increased their interest and that the use of multiple characters could make the presentation even more appealing. More than half of the students expressed their opinions in terms of attracting attention and emphasized the contribution of the agent's animated presentation, enriched with voice, gestures, and facial expressions, to attracting their attention to the lesson.

> *"The impressive tone of voice and the use of gestures and facial expressions made me pay more attention to the topic. (H1)"*
> *"If they had talked continuously, it would have been a bit difficult for me to focus in some places. They were good, I liked them, I was able to focus. (H10)"*

Eight of the students who participated in the interview expressed their trust in the agent, while five students stated that their self-confidence had increased. The students mentioned that they felt the agent was knowledgeable about the subject matter, and that his confident tone of voice and ability to explain the subject as if he were a real teacher influenced their trust in him and strengthened their motivation. A group of students also mentioned the agent's contribution to their self-confidence, stating that they felt relaxed, secure, and confident as they practiced what they had learned.

> *"He explains things in more detail, and we already know a lot because we've actually done it in practice before coming to class. This time, we feel more comfortable doing it because we've learned it… We feel more confident. (H7)"*
> *"His voice was very reassuring… it made me feel safe in any situation. (H8)"*

Fifteen students stated that the rich learning experiences provided by the agent enabled them to thoroughly enjoy the learning process. They also said that the attention-grabbing and motivating feedback provided alongside the presentation made the learning process more effective.

> *"I liked the visuals there; they were very entertaining and made me more interested in the lesson. (H5)"*
> *"I lose focus very quickly, so I liked that the videos were short and ended with a short quiz. (H15)"*

Almost all of the students interviewed stated that they felt they were in a more social learning environment thanks to the agent's teacher- or friend-like communication style, while fifteen students said that they felt an emotional connection and sincerity due to the agent's sincere style. They mentioned that the agent's warm, supportive, and

friendly interaction through his speaking style, hand gestures, facial expressions, and occasional jokes contributed to their ability to follow the lesson without losing focus. At the same time, there were also a few students who said that the agent's presence did not make a difference to them, that they could not develop a bond with the agent, and that they could not feel friendship toward him.

> *"… it made me feel secure, supportive, and positive towards me… (H5)"*
> *"I didn't feel like a friend… It didn't matter to me whether it was there or not, I couldn't connect with it. (H2)"*
> *"...speaking in a more friendly, teacher-like, or sincere manner allowed me to listen to the lesson without losing focus. (H9)"*

Students' Opinions on the Static Educational Agent

In this section, qualitative data reflecting students' views on the static and stationary educational agent were analyzed. The findings obtained from the analysis were grouped under five main themes: *'Use of Voice, Appearance of the Agent, Learning Process, Interaction, and Motivation'*. Figure 2 shows the main themes and the code categories under these themes.

Use of Voice

Students' opinions on voice usage were examined and categorized into three categories: *'Voice Clarity and Quality', 'Voice Features',* and *'Style of speaking'*. The code categories and codes are presented in Table 6.

Table 6. Code Categories and Codes for the Use of Voice in Static Educational Agents

Main Theme	Code Category	Codes	f	Students
Use of Voice	*Voice Clarity and Quality*	Voice clarity	4	hs6, hs10, hs17, hs19
		Intelligibility	6	hs1, hs6, hs7, hs9, hs10, hs19
	Voice Features	Intonation	12	hs2, hs3, hs4, hs5, hs6, hs10, hs11, hs12, hs16, hs18, hs19, hs20
		Emphasis	3	hs11, hs19, hs20
	Style of speaking	Robotic/natural voice	6	hs3, hs5, hs7, hs10, hs14, hs17
		Sincerity/formality	8	hs1, hs3, hs5, hs11, hs16, hs17, hs18, hs20

Four of the students interviewed emphasized the agent's clear and concise manner of speaking, while six commented on the clarity and memorability of his diction, stating that these qualities increased his effectiveness.

> *"I think his diction is very good, more memorable. ... he speaks in a way that is easy to understand. (HS1)"*
> *"The best thing about him is that he explains things clearly, speaks clearly, provides clear information,*

and gives us what we need. (HS17)"

Twelve students emphasized the agent's intonation and stated that his dynamic and interesting intonation contributed to drawing their attention to the content. Three of the students also pointed out that the agent emphasized important points by using his voice.

> *"The tone of voice was very nice and interesting. It was attention-grabbing, meaning that I enjoyed listening to it. (HS2)"*
>
> *"The emphasis in the educational agent's voice really motivated me. (HS11)"*

Six of the students focused on whether the agent's voice sounded human or robotic. Some students commented on the sincerity and formality of the agent's voice, while some students stated that the jokes made from time-to-time added warmth. On the other hand, it was also noted that the sincere expressions used sounded artificial.

> *"I think it's nice that he laughs and jokes around sometimes. It's a friendly environment. (H1)"*
>
> *"I think he was a very educational person, his voice was educational, he was like a human being. (H5)"*
>
> *"It didn't seem sincere; a person wouldn't talk like that. (H17)"*

Appearance of the Agent

Students' views on the appearance of educational agents were examined under two categories: *'General Design and Visual Features',* and *'Gender Perception'.* The code categories and codes are presented in Table 7.

Table 7. Code Categories and Codes for the Appearance of the Agent in Static Educational Agents

Main Theme	Code Category	Codes	f	Students
Appearance of the Agent	*General Design and Visual Features*	Motionless Position	20	hs1, hs2, hs3, hs4, hs5, hs6, hs7, hs8, hs9, hs10, hs11, hs12, hs13, hs14, hs15, hs16, hs17, hs18, hs19, hs20
		Appearance Type	17	hs1, hs3, hs5, hs6, hs7, hs8, hs9, hs10, hs11, hs12, hs14, hs15, hs16, hs17, hs18, hs19, hs20
		Expectations of Facial Expressions and Gestures	18	hs1, hs2, hs3, hs4, hs5, hs6, hs7, hs8, hs9, hs11, hs12, hs13, hs14, hs16, hs17, hs18, hs19, hs20
	Gender Perception	Not Important	12	hs1, hs2, hs3, hs4, hs6, hs9, hs10, hs11, hs12, hs13, hs16, hs17
		Preference	5	hs5, hs14, hs7, hs8, hs15

All students who participated in the interview expressed their opinions about the agent's fixed posture. Students stated that the simplicity of the static agent increased their focus and helped them concentrate on the material.

Some students also mentioned that they thought the agent's movement would increase its attractiveness. Nearly all of the students (n=17) commented on the appearance of the educational agent, emphasizing that its human-like features created the feeling of having an educator in the learning environment. They stated that they found the character design of the static agent realistic and impressive, and that even though it was not human, it felt human. The students emphasized that the agent's ability to express itself not only with voice or a static face, but also with simultaneous facial expressions and hand movements would enrich the interaction.

"...I didn't want a more dynamic image; simplicity made it easier to focus. (HS1)"
"It could have had facial expressions. It could have had a more realistic feel, as if it were face-to-face training. (HS14)"

Twelve students who participated in the interview in the static agent group stated that the gender of the agent did not determine their learning experiences. The students emphasized that the quality and clarity of the voice were more important than gender. Five students expressed a preference regarding the gender of the agent and suggested that a different gender option could affect motivation and closeness.

"As long as I can understand what he says, it doesn't matter whether the voice male or female. (HS1)"
"...if I had a choice, I would prefer a female voice. (HS5)"
"If it were a woman, it would sound warmer and more sincere. (HS14)"

Learning Process

The views of students in the static agent group regarding the contribution of the educational agent to the learning process were analyzed under three main categories: *'Acquiring Knowledge', 'Facilitating Learning',* and *'Participation and Commitment to Learning'.* The code categories and codes are presented in Table 8.

Table 8. Code Categories and Codes for the Learning Process in Static Educational Agents

Main Theme	Code Category	Codes	f	Students
Learning Process	*Acquiring Knowledge*	Explanatory narration	8	hs1, hs4, hs6, hs8, hs9, hs10, hs16, hs19
		Expertise	7	hs1, hs2, hs3, hs5, hs7, hs13, hs16
		Teaching	4	hs5, hs10, hs14, hs20
	Facilitating Learning	Learning Support	9	hs2, hs4, hs5, hs7, hs11, hs14, hs15, hs16, hs19
		Contributing to the Application	14	hs1, hs2, hs3, hs7, hs9, hs10, hs11, hs13, hs14, hs15, hs16, hs17, hs19, hs20
	Participation and Commitment to Learning	Participation in the Process	3	hs3, hs10, hs11
		Agent Incentives and Entertainment	13	hs1, hs2, hs3, hs5, hs8, hs10, hs12, hs13, hs14, hs15, hs17, hs18, hs20

Eight of the students interviewed emphasized that the agent's presentation of the topic using both visual and voice instructions facilitated understanding. Seven students commented on the agent's mastery and expertise on the topic, while four mentioned the agent's educational style, examples, and detailed explanation of the application steps as contributing factors.

> *"The agent shows how to do it with both visual and audio explanations. It is better for the agent to show the information rather than just reading and understanding it. I think it has a positive effect. (HS1)"*

In terms of facilitating learning, nine of the students interviewed highlighted the agent's learning support function. The students stated that the visual and verbal guidance provided by the agent guided them in completing their assignments step by step. In addition, fourteen students expressed their opinions in terms of contributing to the application process. Students stated that thanks to the guidance provided by the agent through visual and voice explanations, they were able to see how to perform the applications and maintain their motivation; as a result, they were able to learn even difficult topics in an enjoyable and stress-free manner.

Furthermore, students expressed that the agent's ability to test what they had learned, immediately show and correct their mistakes, enabled them to progress faster and with fewer errors in the applications.

> *"After finishing the topic, explaining it and showing the applications in some way made it easier for me to do my homework. It was a great contribution. Because we came to class having already learned the material. He explained it and also showed us how to do it in practice. (HS2)"*
> *" ... they contributed a lot. I was able to do things I didn't know at all, without any difficulty and in a very fun way. (HS20)"*

Thirteen students in the group mentioned that the agent's fun and encouraging nature contributed to their participation in the lesson, while three students emphasized the agent's interactive presentation, stating that it enabled them to actively participate and be directly involved in the process.

> *"It was fun, the assignments and responsibilities were good. It made me enthusiastic about other topics, so as I learned more, I felt that it would be better to learn more details. (HS8)"*
> *"...his examples and involving us in the event were effective. It was more effective when we were involved. For example, we didn't just watch the video and move on. He gave us a responsibility or something to do. It was interactive. (HS10)"*

Interaction

Student opinions regarding the interaction between static educational agents and students were examined under three categories: *'Feedback', 'Providing Guidance* and *Direction', and 'Interaction Dynamics'.* The code categories and codes are presented in Table 9.

Table 9. Code Categories and Codes for the Interaction in Static Educational Agents

Main Theme	Code Category	Codes	f	Students
Interaction	Feedback	Informative Feedback	4	hs1, hs6, hs8, hs11
		Affirmative Feedback	13	hs2, hs3, hs6, hs7, hs8, hs9, hs10, hs11, hs12, hs13, hs16, hs17, hs20
	Providing Guidance and Direction	Explanatory Guidance	6	hs4, hs5, hs6, hs8, hs12, hs16
		Visual Guidance	5	hs2, hs5, hs7, hs12, hs13
		Verbal Guidance	5	hs6, hs8, hs9, hs11, hs12
	Interaction Dynamics	Student-Agent Interaction	9	hs2, hs3, hs5, hs7, hs10, hs12, hs16, hs17, hs18
		Assessment and Expectations	8	hs4, hs6, hs7, hs8, hs10, hs11, hs13, hs14
		Activity	7	hs7, hs8, hs9, hs10, hs12, hs13, hs14

Four of the students interviewed mentioned that the educational agent provided informative feedback in the context of interaction, stating that the educational agent's simultaneous explanations of their mistakes in detail and showing the correct answers during the activities that took place throughout the learning process enabled them to recognize their own sources of error and make corrections. Thirteen students expressed their opinions regarding the affirming feedback provided by the educational agent to students. Students stated that instant positive expressions such as "Bravo", "You're great", and "Keep going" received from the one-on-one agent increased their perception of success and motivation, while encouraging words such as "You can try again", "Don't worry, you can do it again".

> *"I liked it when they said 'congratulations' when I did something right. (HS2)"*
> *"It made me feel like I could do it. They gave feedback. I think giving feedback such as 'well done,' 'you're doing well', and 'that's the right answer' is motivating. (HS8)"*

Students emphasized that the agent's clear and structured instructions made it easy for them to follow the application steps. Five students mentioned that visual guidance, such as on-screen markings, example slides, and live demonstration elements, helped them apply concepts in practice and speed up assignment tracking. Five students highlighted verbal guidance, stating that the agent involved them in the process through voice commands.

> *"First, he demonstrated it, then he assigned homework. ... it was very beneficial for me that he demonstrated it and then let me do the homework. It was a significant advantage. (HS2)"*
> *"...He guided me, and then it was easier to apply in practice. (HS4)"*

Nine of the students interviewed emphasized that the agent's clickable interactions and instant conversations made the learning process more dynamic and participatory. A group of students expressed their expectations regarding their interactions with the agent, requesting the addition of two-way dialogue and live question-and-answer

features supported by artificial intelligence. Seven of the students emphasized that the agent's continuous voice commands and clickable interactions helped them focus their attention.

> *"We had to click on the screen to keep our attention on the lesson. It guided us, which helped me focus on it. (HS9)"*
>
> *"Seeing and feeling that what I was doing was live increased my attention. It was talking to me, addressing me, guiding me... (HS17)"*

Motivation

The students' views on motivation in the static agent group were analyzed and discussed under four main categories: *'Attention and Focus', 'Confidence', 'Satisfaction',* and *'Feeling of Closeness'.* The code categories and codes are presented in Table 10.

Table 10. Code Categories and Codes for the Motivation in Static Educational Agents

Main Theme	Code Category	Codes	f	Students
Motivation	*Attention and Focus*	Focus	10	hs9, hs10, hs11, hs12, hs13, hs14, hs15, hs16, hs17, hs18
		Attention and Retention	14	hs1, hs2, hs3, hs4, hs5, hs6, hs9, hs10, hs11, hs12, hs15, hs18, hs19, hs20
		Interest	8	hs5, hs6, hs7, hs8, hs9, hs15, hs18, hs20
	Confidence	Trust in the Agent	8	hs5, hs6, hs8, hs11, hs13, hs17, hs18, hs20
		Self-Confidence	5	hs2, hs6, hs7, hs11, hs16
	Satisfaction with the Learning Process	Enjoyment of the Process	15	hs2, hs3, hs5, hs6, hs8, hs9, hs10, hs11, hs13, hs14, hs15, hs16, hs17, hs19, hs20
		Efficiency	5	hs7, hs8, hs9, hs16, hs18
	Feeling of Closeness	Social Relationship Building	17	hs1, hs2, hs3, hs4, hs5, hs6, hs7, hs8, hs9, hs10, hs11, hs12, hs14, hs15, hs16, hs17, hs20
		Emotional Bond and Sincerity	15	hs1, hs2, hs4, hs6, hs7, hs8, hs9, hs11, hs13, hs14, hs15, hs16, hs17, hs18, hs20

Ten of the students interviewed focused on the agent's static and fixed presentation, stating that this prevented distractions and made it easier for them to focus solely on the lesson content. Fourteen students stated that the interactive signals and cues provided by the agent helped them maintain their focus throughout the lesson and suggested that adding small movements or facial expressions could increase attention. Eight students stated that the agent's innovative narrative style and dynamic modulations aroused their curiosity and drew their attention to the lesson.

> *"We had to click on the screen to stay focused on the lesson. It kept directing us, which helped me stay focused. (HS9)"*
>
> *"I think it could have been more effective with movement and sound. Of course, it was a little strange to have it standing there like a robot. (HS10)"*

Eight students expressed the view that the educational agent's trust motivated them. Students emphasized that the agent was perceived as a reliable learning partner due to its human form, consistent communication efforts, and feedback mechanisms that immediately corrected mistakes. Five students mentioned that the agent's supportiveness and guidance contributed to increasing their self-confidence.

> *"The agent constantly tried to communicate; this is how he gained my trust and friendship. (HS13)"*
>
> *"When I made a mistake, he would tell me the right answer; I trusted him. (HS11)"*

Fifteen students who expressed enjoyment of the process stated that the agent's narrative style, responsibility-giving assignments, and interactive flow made the learning process fun and motivating. Five students similarly emphasized that the agent's fluent narrative and application-oriented guidance made the learning process effective and time-efficient.

> *"I liked the way the topic was presented. It contributed to the learning process. I appreciated that he showed us beforehand and gave us a preview. It was enjoyable. (HS2)"*
>
> *"The combination of practical application, having the video in the background, and the instructor explaining at the same time was effective. (HS18)"*

Almost all of the students (n=17) reported that the agent's friendly approach made them feel like they had established a "friendship" with the agent, which increased their motivation for the course. Fifteen students emphasized the emotional bond they formed with the agent, stating that the agent's sincere address, genuine attitude, and humorous approach supported the formation of emotional bonds, which in turn contributed to their motivation. Some of the students in the group suggested that a presentation focused solely on guidance could weaken the feeling of closeness over time, and that adding slight facial expressions or movements to the agent could further strengthen the feeling of closeness.

> *"I felt a little closer because he spoke more sincerely in general. ... I could have been closer if he had been more lively, like a real teacher. (HS12)"*
>
> *"He constantly tries to communicate; this is how he gained my trust and friendship. (HS13)"*

Students' Opinions on the Voice Educational Agent

This section analyzes qualitative data reflecting students' views on the educational agent designed solely for voice use. The findings obtained from the analysis were grouped under four main themes: *'Use of Voice, Learning Process, Interaction,* and *Motivation'*. Since the agent did not have a visual representation, the *'Agent*

Appearance' theme was excluded from this group. Figure 2 shows the main themes and related code categories.

Use of Voice

Students' views on voice use were examined and categorized into four categories: *'Voice Clarity and Quality', 'Voice Features', 'Style of speaking',* and *'Voice Gender Perception'.* The code categories and codes are presented in Table 11.

Table 11. Code Categories and Codes for the Use of Voice in Voice Educational Agents

Main Theme	Code Category	Codes	f	Students
Use of Voice	*Voice Clarity and Quality*	Voice clarity	4	s3, s4, s10, s16
		Intelligibility	7	s2, s3, s4, s8, s10, s14, s20
	Voice Features	Intonation	10	s1, s3, s5, s7, s8, s10, s13, s14, s15, s17
		Emphasis	5	s1, s4, s15, s17, s19
		Voice level	11	s3, s5, s7, s8, s9, s10, s11, s12, s14, s15, s17
	Style of speaking	Robotic/natural voice	12	s3, s5, s7, s8, s9, s11, s12, s13, s14, s16, s17, s20
		Sincerity/formality	12	s3, s5, s7, s10, s11, s12, s14, s15, s16, s17, s19, s20
	Voice Gender Perception	Gender perception	13	s1, s3, s5, s7, s8, s9, s10, s13, s14, s15, s16, s18, s20
		Gender preference	6	s2, s4, s11, s12, s17, s19

Four of the students interviewed commented on the clarity of the voice. The students stated that the agent's voice was not muffled, that he spoke clearly and emphatically, and that his proper diction made it easy to follow the content. Seven students expressed their opinions on the clarity of the voice, stating that the agent's explanations were simple, clear, and easy to follow, and that they were able to easily understand the content thanks to the use of understandable language.

> *"He spoke very clearly. His diction was good. (S3)"*
> *"His voice was pleasant. He did not have a hoarse voice. He had a very clear and emphatic tone of voice. (S10)"*

Ten students stated that they found the voice agent's tone of voice entertaining, attention-grabbing, and emotional. Five students commented on the voice agent's emphasis. Some students stated that the voice agent's emphasis on important words was motivating. Students (n=11) who emphasized that the volume level increased at times and helped them focus on the lesson mentioned that this increased their attention, but also noted that it could cause distraction at certain points due to being too loud.

> *"Sometimes the tone of your voice changes instantly, which helps me focus. (S13)"*
> *"The volume was very high. So, at some points, it would have been better if the volume was lowered a little. It was a bit confusing. (S17)"*

Twelve of the students interviewed in the voice agent group rated the voice style as "robotic" or "natural." While most students described the agent's voice as artificial, mechanical, or robotic, some believed that differences in intonation made the voice sound more human and realistic. A significant portion of the students (n=12) expressed opinions regarding the level of sincerity or formality of the voice, stating that the agent used a friendly, sincere, and genuine tone.

> *"It seemed artificial. It gave me a slightly fake feeling. (S3)"*
> *"They were more approachable and sincere. It was like studying with a friend who was explaining the lesson to me. (S12)"*
> *"Because there were changes in the tone of voice, it felt like a real person was explaining it to you. (S16)"*

Thirteen students expressed their opinions about the gender of the agent's voice. Although some students thought that gender was not important, the majority of students stated that the voice was impressive regardless of gender. Only six students indicated a preference for the gender of the agent's voice, emphasizing that they would prefer a female voice because it could be sincerer or understandable. Students who preferred a male voice stated that they liked it that way.

> *"To be honest, I don't really differentiate between men and women, but it was a nice tone. I liked the voice. (S15)"*
> *"I think it would be nicer if it were a woman's voice. (S17)"*

Learning Process

Student opinions on the contribution of voice educational agents to the learning process were examined under three categories: *'Acquiring Knowledge', 'Facilitating Learning',* and *'Participation and Commitment to Learning'* as presented in Table 12.

Table 12. Code Categories and Codes for the Learning Process in Voice Educational Agents

Main Theme	Code Category	Codes	f	Students
Learning Process	*Acquiring Knowledge*	Explanatory narration	6	s2, s3, s4, s14, s16, s20
		Expertise	11	s2, s3, s5, s7, s9, s10, s12, s13, s14, s17, s18
		Teaching	3	s2, s16, s17
	Facilitating	Learning Support	9	s2, s5, s6, s7, s12, s13, s14, s15, s18

Main Theme	Code Category	Codes	f	Students
	Learning	Contributing to the Application	7	s6, s8, s9, s10, s12, s16, s20
	Participation and	Participation in the Process	5	s2, s4, s11, s17, s19
	Commitment to Learning	Agent Incentives and Entertainment	13	s4, s5, s6, s8, s9, s10, s11, s12, s15, s16, s17, s19, s20

Six students stated that the agent conveyed the topics in a simple, clear, and understandable manner, while 11 students stated that the agent was knowledgeable about the subject and presented the information in detail, like a teacher. Three students drew attention to the agent's teaching skills and stated that his use of educational language facilitated their learning.

> "The agent was knowledgeable because he made me feel like he was a real teacher. It was sufficient. (S9)"
>
> "There are educational things in it. He taught by explaining the topic in a short and concise manner. (S16)"

Nine of the students interviewed stated that the agent provided learning support. Students who compared the voice narration with the text stated that it was more explanatory and attention-grabbing than the text. Seven students stated that the agent's voice instructions made the assignments and applications easier to understand and that they could be followed step by step and put into practice.

> "It's good to have sound; it wouldn't be as good if it were just text. It's more impressive and memorable. (S2)"
>
> "It contributed because I was able to understand what he taught, so I could apply it to my own practice. (S9)"
>
> "The voice helped me focus on the lesson and was always supportive in the applications. He explained and guided me, so I didn't need any other resources, to be honest. (S18)"

Five of the students interviewed emphasized that they actively participated in the lesson thanks to the agent's practical explanation and thus became part of the process. On the other hand, thirteen students stated that the agent's pleasant tone of voice made the lessons enjoyable and motivated them to work.

> "Voice guidance was great. I felt like I understood better when it was audible, and I was more comfortable actively participating in the exercises. (S4)"
>
> "It was fun; if it had been silent instruction, it wouldn't have been effective. The voice made me interested in other topics as well. (S20)"

Interaction

Student opinions regarding the interaction between voice educational agents and students were examined under three categories: *'Feedback', 'Providing Guidance and Direction',* and *'Interaction Dynamics'.* The code categories and codes are presented in Table 13.

Table 13. Code Categories and Codes for the Interaction in Voice Educational Agents

Main Theme	Code Category	Codes	f	Students
Interaction	*Feedback*	Informative Feedback	3	s5, s11, s17
		Affirmative Feedback	9	s2, s4, s5, s6, s8, s9, s12, s15, s17
		Negative Feedback	6	s1, s3, s4, s10, s12, s13
	Providing Guidance and Direction	Explanatory Guidance	10	s4, s6, s7, s9, s10, s12, s16, s17, s18, s19
		Verbal Guidance	10	s1, s2, s3, s4, s6, s7, s10, s11, s14, s15
	Interaction Dynamics	Student-Agent Interaction	10	s2, s5, s6, s7, s9, s10, s13, s14, s15, s17
		Assessment and Expectations	7	s4, s5, s9, s11, s12, s13, s14
		Activity	8	s3, s4, s8, s9, s14, s15, s17, s20

Three of the students interviewed stated that the agent's corrective feedback in an explanatory manner contributed to their learning. Nine students stated that the agent's affirmative feedback motivated them and increased their appreciation and self-confidence. Six students expressed negative opinions, stating that they found the feedback artificial or insufficient. They said that they did not feel that the feedback was realistic and that this had a negative effect on their motivation.

> *"To be honest, the feedback didn't motivate me much; it even seemed insincere, not real. (S1)"*
> *"For example, when I got a question wrong, they would explain the topic, which was more motivating. (S5)"*
> *"Sometimes it seemed very artificial… The feedback was always fake. (S12)"*

Half of the students interviewed expressed that the agent's instructions were clear, stating that they improved their mastery of the material and made it easier for them to complete their assignments independently. Ten students who commented on verbal guidance stated that the agent's direct guidance through voice commands improved their performance during the application process.

> *"He helped us get used to the material by explaining everything and guiding us through it. (S4)"*
> *"He tells us what to do and how to do it. That's why I was able to do better. (S7)"*

Half of the students emphasized that the interactive elements of student-agent interaction facilitated active participation in learning and completion of assignments. Seven students indicated that they needed enriched interaction mechanisms, expressing their desire to interact with the agent in real time and see characters on the screen accompanied by sound. Eight students stated that the agent's guidance, feedback, and continuous interaction through various applications supported their active participation in the course.

> *"If we could see a character… seeing it and feeling it are two different things; it would make me feel more active. (S11)"*
>
> *"…it guided me, kept me active, I didn't just sit there passively. That's why it was good. It wasn't monotonous. (S15)"*

Motivation

The students' views on motivation in the voice agent group were analyzed under four main categories: *'Attention and Focus', 'Confidence', 'Satisfaction',* and *'Feeling of Closeness'.* The code categories and codes are presented in Table 14.

Table 14. Code Categories and Codes for the Motivation in Voice Educational Agents

Main Theme	Code Category	Codes	f	Students
Motivation	*Attention and Focus*	Focus	10	s1, s4, s5, s8, s9, s10, s14, s15, s17, s18
		Attention and Retention	4	s2, s13, s15, s17
		Interest	5	s2, s7, s13, s17, s19
	Confidence	Trust in the Agent	9	s2, s5, s7, s9, s12, s13, s14, s17, s18
		Self-Confidence	5	s7, s11, s14, s15, s17
	Satisfaction	Enjoyment of the Process	12	s1, s2, s4, s5, s7, s8, s9, s11, s15, s17, s19, s20
		Efficiency	7	s4, s7, s9, s12, s14, s16, s19
	Feeling of Closeness	Social Relationship Building	9	s2, s4, s8, s10, s12, s13, s14, s16, s18
		Emotional Bond and Sincerity	10	s1, s3, s5, s7, s10, s12, s13, s14, s15, s16

Ten of the students interviewed mentioned that the agent's non-monotonous, rhythmic intonation and guiding narration helped them focus, while four students mentioned that the agent kept their attention constantly alert with feedback and guiding strategies, which they found motivating. The students said that the agent's innovative approach to presenting the lesson was interesting and caught their attention. One student interviewed mentioned that the agent's constant talking made it difficult to focus.

> *"Even if our focus wanders, it says something, and you can immediately refocus. It guides us. It tells us*

that if we click here, we will see the content. It aroused our curiosity. (S10)"

"The fact that it keeps talking sometimes distracts me, takes my attention away. It starts to feel like a fairy tale at times. (S13)"

Nine students emphasized that the agent's mastery of the subject matter and error-free presentation instilled a sense of confidence, while five students stated that the agent's motivating feedback and praise strengthened their belief in their own success.

"He knew the subject; he didn't make mistakes. That's why I trusted his knowledge. (S2)"

"Even if we did something wrong, he said motivating things, so we didn't feel like we had failed; the more we succeeded, the more I wanted to do it. (S17)"

Twelve students emphasized that the agent's fun tone of voice and the fact that it was a different application for them made the learning process enjoyable. Seven students stated that the agent's voice narration served as an effective learning tool.

"The tone of voice was fun. Also, creativity was involved in the program. (S5)"

"I believe that voice is a powerful tool for learning. (S19)"

Nine of the students interviewed mentioned the connection they established with the agent, emphasizing that the agent's friendly attitude made them feel as if they were working on the topics with their own friends, and that this facilitated their participation in the process. Ten students stated that the agent established an emotional connection with them by using a friendly and sincere tone, noting that this sincerity helped them form an emotional bond. However, some students also believed that this sincerity in the digital environment felt artificial and insincere.

"He made me feel close to him by using sincere language. He seemed like a friend. (S3)"

"I don't believe you can be honest or sincere unless you are human; I didn't find him very sincere. (S1)"

Comparative Evaluation of Agent Types

In this section, student opinions regarding three different types of educational agents are comparatively analyzed based on identified themes. As the agent's voice is consistent across all groups, the primary differences lie in the level of animation and the presence of visual elements. Students in the animated and static agent groups, whose visual designs were evaluated, highlighted that human-like facial expressions and thoughtful color-costume choices contributed to a warm and realistic learning atmosphere. Both groups suggested that incorporating natural details and vivid colors into the agent's appearance could enhance its credibility. The animated agent was praised for providing dynamism and liveliness through its holistic movements, while the static agent was noted for promoting focus through its simplicity. Additionally, students recommended incorporating more sophisticated animations for the animated agent and enhancing the static agent with gestures and facial expressions to enrich the learning experience.

The findings indicate that, from a general student perspective, clarity and intelligibility of the agent's voice were considered crucial for effective learning across all agent types. In the animated agent group, opinions on speech speed were mixed, with some students perceiving it as too fast and others as too slow. Across all groups, students observed that highlighting key information through voice helped them focus better, while lively and dynamic intonation was identified as an important factor in increasing their motivation. Based on these findings, this variability in voice intonation not only serves a motivational purpose but also functions as an effective strategy for capturing and sustaining students' attention in online classroom settings. Fluctuations in sound level were evaluated differently across the groups. Students in the animated agent group highlighted these variations as engaging, while some in the voice-only agent group considered them distracting. Regarding the style of the voice, students expressed differing opinions on whether it sounded "robotic" or "human." Natural voices were described as fostering sincerity and a sense of connection, whereas mechanical voices were perceived as reducing the feeling of closeness.

In all types of agents, students reported that the educational agents presented topics in a simple and understandable manner, demonstrating a high level of expertise. They perceived this as making the learning process easier. Students also emphasized that the agents not only provided information but reinforced learning through an instructive attitude and practical, exemplary explanations. Furthermore, the agents' entertaining features were noted to enhance participation and engagement in lessons. Step-by-step guidance and verbal explanations were particularly appreciated for their role in facilitating learning. In the animated agent group, students highlighted that gestures and facial expressions enriched the learning experience. In the static agent group, they noted that the simultaneous presentation of visual and verbal content helped increase focus. Meanwhile, students in the voice-only agent group expressed that verbal narration and guidance supported the completion of homework and applications.

Students remarked that these features collectively contributed to a more engaging and effective learning experience. In particular, those in the animated agent group emphasized that the combination of gestures, facial expressions, and dynamic movements added a human-like quality, making the learning environment feel more interactive and relatable. Similarly, students in the static agent group appreciated the simplicity and clarity provided by the agent's design, which they perceived as reducing distractions and fostering better concentration during lessons. In the voice-only agent group, students highlighted the clarity of verbal instructions as particularly beneficial for guiding their independent study and completing tasks. They noted that the agent's straightforward and consistent tone helped them stay focused, even in the absence of visual cues. Across all groups, students frequently mentioned that the agents' design features were effective in addressing their individual learning needs thus enhancing both their engagement and overall understanding of the material.

When examining student opinions regarding their interaction with the agent across all groups, it was found that the feedback provided by the agent facilitated mutual student-agent interaction, thus supporting motivation and learning. Students from all groups expressed positive opinions about informative feedback. They noted that affirming feedback such as "Congratulations!" and "Bravo!" increased their self-confidence and encouraged greater participation in the lesson. However, some students in the animated and voice agent groups expressed

negative views, stating that the feedback appeared artificial and insufficient. Students across all groups reported that the agent's instructions helped them stay focused, with the feedback serving as a motivating factor that kept them engaged in the lesson. Interaction was perceived as more personal and intense in the animated agent group, where students mentioned that gestures, facial expressions, and visual instructions made the agent feel like a friend. In contrast, students in the static agent group found the voice instructions and structured narration effective despite the lack of visual movement, although they suggested incorporating more interactive designs. In the voice agent group, while auditory interaction was considered sufficient, students felt that the absence of visual elements limited the depth of interaction.

According to students' perspectives on motivation, it was emphasized that presentations across all types of agents should avoid monotony, as this helps students stay focused on the lesson. Animated agents-maintained attention through gestures and facial expressions, while static agents used signs and voice agents relied on intonation and verbal cues. Students expressed that they trusted the agent's expertise, enjoyed the learning process due to its entertaining presentation, and felt more motivated. Sincere communication was seen as enhancing emotional closeness and participation in the learning experience. While the animated agents' gestures, facial expressions, hand movements, and jokes created a real human feeling and facilitated emotional closeness, it was suggested that adding additional movements or facial expressions to the static agents would further increase emotional closeness. While some of the students in the voice agent group felt an emotional closeness due to the friendly and sincere voice, others stated that they could not feel it because it was a digital learning environment.

Discussion and Conclusion

Within the scope of this research, students' views on the use of educational agents were investigated in depth. Research results show the effect of speech intelligibility, emotional impact, tone of voice, and speaking style on the learning process. Students have stated that speech clarity, diction, intonation, and speaking speed directly affect learning processes in terms of speech intelligibility and quality. Some studies in the literature indicate that the intelligibility of the agent voice used in educational materials and the clear articulation of the sentences help students maintain active attention (Mayer, 2009; Sweller, 2010). In addition, it has been stated that the use of a voice with proper and fluent diction ensures that the intended message is conveyed meaningfully and, as a result, contributes to students' faster comprehension of the subject (Moreno & Mayer, 2000). In Atkinson's studies, it is emphasized that the speech of educational agents should be clear and understandable (Atkinson, 2002). The intonation of the voice has emerged as an important factor supporting the learning process by students, as it determines the emphasis and emotional expression of the educational agent. Students have indicated that narratives with distinct changes in tone are more attention-grabbing and memorable than monotonous speech. The harmonious use of educational agents' voices and gestures increases the effectiveness of the teaching process (Woo, 2009). Students have stated that maintaining the educational agent's speaking speed at an appropriate level positively affects the comprehension process. A very fast narration may prevent students from fully understanding the information, while a very slow speaking pace may lead to loss of attention. In the studies by Weiss et al. (2015), it was stated that the speaking speed of educational agents should be natural and understandable, and it was concluded that a narration at a pace appropriate to student expectations improves the learning experience.

Students stated that the sincere, warm, energetic, and encouraging speech of the educational agent attracted their attention and increased their motivation. The use of a supportive, guiding, and encouraging style plays a critical role in ensuring active participation in the learning process (Haake, 2009). Students' views on the intelligibility and quality of the voice reveal that it is an important component in the design of educational agents. The voice used in educational agents must be selected in a way that contributes to the learning process of students. The balanced use of factors such as clarity, diction, intonation, and speed plays a critical role in enabling students to maintain their attention and better understand the content.

The visual design of the educational agent is also an important factor that directly affects the student experience and learning process. In this study, some students evaluated educational agents with animated gestures and facial expressions as more dynamic, interesting, and interactive, while some students stated that they could be distracting and tiring. Although motionless agents were found to increase focus, some students perceived them as static and inadequate. As in this study, studies on educational agents have concluded that a balanced level of movement supports the learning process and makes the agent more interesting (Lusk & Atkinson, 2007; Schroeder et al., 2014; Li et al., 2022; Tao et al., 2022). The use of sincere and natural facial expressions and gestures by agents was found to be more impressive and reliable by students. While fun and motivating facial expressions increased students' interest, some students stated that facial expressions that were perceived as artificial or inadequate weakened the agent's ability to establish an emotional connection.

Similarly, the literature has revealed that human-like agents designed to elicit emotional responses increase student participation in the learning process (Gulz & Haake, 2006; Anasingaraju et al., 2020; Liew et al., 2022). In this context, it is recommended that educational agents be designed in a realistic, aesthetically pleasing manner that meets student expectations. The gender of educational agents was not considered important by some students. Some students expressed a preference for being able to choose the gender of the agent. Therefore, it is recommended that educational agents be customizable according to student preferences. The findings emphasize the importance of considering student feedback when designing educational agents and offering customization options that will adapt to individual learning needs. A balanced approach to factors such as mobility, facial expressions, aesthetic design, and gender can make educational agents a more effective tool in the learning process.

The contributions of educational agents to the learning process may vary depending on how they present the content and how they interact with students. The animated agents used in the learning environments developed within the scope of this study increased human-computer interaction and created a dynamic environment that encouraged participation in learning. While static agents were perceived by students as a reliable learning resource with their systematic presentation of the subject matter, voice agents were described as an element that increases focus and provides motivation with their voice guidance and as a support mechanism that guides learning. Students stated that educational agents presented information in a systematic, clear, and practical manner. In addition, they stated that the educational agent's presentation of information in pieces, along with voice and visual instructions, helped them understand the subject better and perceive it as a guide. The use of supporting graphics and animations in subject explanations helps students understand the subject better (Haake, 2009; Weiss et al.,

2015). Educational agents increased students' interest and motivation by providing sincere and encouraging feedback. Students stated that personalized feedback contributed to the learning process. The feedback provided by educational agents to students helps correct mistakes and reinforce learning (Beun et al., 2003).

The fact that educational agents have a fun and interactive structure helps students participate more in the learning process (Davis et al., 2023). In this study, the use of gestures and facial expressions by animated agents, their use of body movements to give directions, and their provision of encouraging feedback were evaluated as factors that increased students' interest in the lesson. This supports previous studies that social interaction and human-like behaviors can increase students' motivation to learn (Moreno et al., 2001; Dinçer, 2015). It has been stated that the static structure of static agents does not distract students and helps them focus. However, some students in this group stated that more movement and facial expressions in static agents could increase motivation, which may be an indication of their need for this. Studies show that students interact more with educational agents with whom they form social and emotional bonds and participate more in the learning process (Atkinson et al., 2005; Mayer & DaPra, 2012; Mayer et al., 2003).

The inclusion of emotional interaction elements strengthens the student-agent bond and personalizes the learning experience. Therefore, it may be recommended that static agents be designed to include more human characteristics. In the voice agent group, students stated that varying the tone of voice, avoiding monotony, and well-adjusted emphasis helped them focus better on the lesson. This finding shows that users perceive the voice guidance of educational agents as a more personal interaction, which contributes positively to the learning process, as emphasized in the studies of Atkinson & Mayer (2005). Some students in the voice agent group stated that the agent being limited to voice only weakened the student-agent interaction and that it should be supported with visual elements. According to the multimedia theory, the combination of visuals and text with voice prompts can make learning more effective (Mayer & Chandler, 2001). In addition, as revealed in the results of this study, educational agents that provide feedback rewarding students' achievements increase motivation toward the learning process (Moreno, 2004). Educational agents' emphasis on students' achievements increases their self-confidence in learning (Haake, 2009). Similarly, in this study, it was observed that the positive, supportive feedback provided by the agent significantly increased students' self-confidence in learning. Consistent with the results of this study, studies in the literature also show that agent feedback strengthens self-confidence in learning (Fountoukidou et al., 2019; Lang et al., 2022; Bian & Zhou, 2022; Sikström et al., 2022; Koskinen et al., 2023).

In conclusion, educational agents are valuable resources that enhance student motivation, provide guidance, and support interaction in the learning process. The findings of this study reveal that animated, static, and voice-based agents were perceived by students with both positive and negative aspects, indicating that preferences vary based on individual interests and needs. This highlights the importance of offering diverse options for educational agents in learning environments. Allowing students to select the type of agent that aligns with their learning styles and expectations is believed to play a critical role in fostering engagement, maintaining attention, and supporting overall motivation. Therefore, it is recommended that future learning materials include a variety of educational agents with distinct characteristics and provide students with personalized choices to optimize their learning experiences.

Notes

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