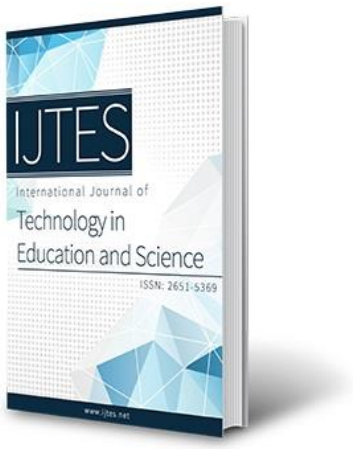

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Oğuz Onat
Istanbul University, Turkiye

Sevinç Gülseçen
Istanbul University, Turkiye

To cite this article:

Onat, O. & Gulsecen, S. (2023). Reducing perceived transactional distance in distance education: The impact of the chatbot. *International Journal of Technology in Education and Science (IJTES), 7*(4), 483-499. https://doi.org/10.46328/ijtes.511

International Journal of Technology in Education and Science
2023, Vol. 7, No. 4, 483-499 https://doi.org/10.46328/ijtes.511

Reducing Perceived Transactional Distance in Distance Education: The Impact of the Chatbot

Oğuz Onat, Sevinç Gülseçen

Article Info

Article History

Received:
24 April 2023
Accepted:
22 August 2023

Keywords

Transactional distance
Chatbot
Technology-mediated interventions
Educational technology
Chatbot usability

Abstract

This study investigates the impact of utilizing a chatbot named 'YakınDost' on the perceptions of transactional distance among distance education students. Transactional distance, which involves communication and interaction between students and instructional personnel, is a critical aspect of distance education. To address this, chatbots are increasingly being employed as tools to facilitate engagement. Developed using IBM Watson Assistant, 'YakınDost' serves as a conversational agent to address common inquiries related to courses, assignments, instructors, exams, and technical matters. The primary objective of this research is to assess how the integration of the 'YakınDost' chatbot influences students' perceptions of transactional distance. To achieve this, the 'Transactional Distance Perception Scale' was administered at the outset and conclusion of the fall semester to first-year students at a state university. Additionally, during the mid-semester, students were introduced to the YakınDost chatbot and were invited to participate in the 'Chatbot Usability Scale.' Out of 2000 students, the data analysis focused on 583 students who completed both pre-test and post-test surveys, among which 398 students interacted with the chatbot. The findings highlight a significant reduction in students' perceptions of transactional distance due to the implementation of the YakınDost chatbot.

Introduction

In the realm of modern education, distance education has emerged as a prominent learning model, facilitated by the rapid advancement of technology. With its inherent flexibility and accessibility, distance education has become a key player in meeting the diverse learning needs of students worldwide. However, like any educational approach, it comes with its unique set of challenges that must be effectively addressed to ensure a fruitful learning experience.

One of the most pressing challenges in distance education revolves around communication and technical issues that can impede the smooth flow of instruction and interaction. These challenges not only hinder students' active engagement in interactive learning activities but also have the potential to erode their motivation to succeed (Özüdoğru, 2021). Furthermore, technical disruptions can lead to frustration and hinder the seamless progression of courses. Nonetheless, the evolution of technology has simultaneously provided solutions to these challenges.

The availability of high-speed internet connections and advanced video conferencing software, for instance, has opened up new vistas for communication and collaboration in distance education (Rashid & Rashid, 2012).

Central to the effectiveness of distance education is the active participation of students in the learning process and their meaningful interaction with instructors. However, a notable hurdle lies in the form of both physical and psychological distances that naturally exist between students and instructional personnel. This phenomenon, coined as "transactional distance" by Moore (1993), encapsulates the space that separates learners from educators in a virtual learning environment. Research suggests that students perceiving a higher degree of transactional distance are more likely to experience lower academic achievement and diminished satisfaction with their learning experiences. To this end, various strategies have been devised to mitigate the negative effects of transactional distance on distance education outcomes.

This study embarks on an exploration of one such strategy: the integration of a chatbot as a potential solution to bridge the gap of transactional distance in distance education settings. By leveraging the capabilities of a chatbot, this research endeavors to shed light on the efficacy of technology-mediated interventions in enhancing student engagement and reducing transactional distance. In light of the aforementioned challenges and potential solutions, this study aims to examine the impact of the 'YakınDost' chatbot on students' perceptions of transactional distance in the context of distance education.

Literature Review

Moore's Transactional Distance Theory

Introduced by Michael Moore in 1973, the Transactional Distance Theory (TDT) aims to explicate the psychological and communicative separation between learners and educators in distance education (Moore, 1973). TDT has been extensively cited in the field of distance education and is employed to elucidate phenomena such as learner satisfaction, motivation, and achievement (Gorsky & Caspi, 2005). Moore conceptualized the Transactional Distance Theory as a combination of three factors: communication, structure, and learner autonomy (Moore, 1993). Communication is defined by the extent and quality of interaction between learners and educators. Structure refers to the guidance and support provided to learners. Learner autonomy denotes the degree to which learners can control their own learning processes.

Components of Transactional Distance

Communication: Communication plays a pivotal role in reducing transactional distance. Interaction among learners and with instructors fosters a sense of community and belonging, thus aiding in diminishing transactional distance (Rovai & Wighting, 2005). Communication is also valuable for clarifying course materials, addressing queries, and providing feedback (Anderson et al., 2001).

Structure: Structure is an effective component in mitigating transactional distance. Offering learners a clear understanding of course goals, objectives, and expectations assists them in staying on track and avoiding feelings

of overwhelm (Benson & Samarawickrema, 2009). Moreover, structure facilitates learners' success by providing guidance and support (Chen & Willits, 1998).

Learner Autonomy: Learner autonomy is a crucial factor in reducing transactional distance. Granting learners the freedom to learn at their own pace and through their chosen methods enhances motivation and reduces transactional distance (Chen et al., 2010). Furthermore, learner autonomy aids in the development of self-directed learning skills (Garrison et al., 2010).

Significance of Perceiving Transactional Distance in Distance Education

With the advancements in technology, distance education has gained prominence in educational processes (Moore & Kearsley, 2011). The perception of transactional distance in distance education encompasses not only the physical distance between students and instructional materials or instructors but also emotional, psychological, and social distances (Moore, 1993). Students' perception of how close or distant they feel from educational materials, instructors, and peers is a component of transactional distance perception.

Literature reviews highlight the pivotal role of transactional distance perception in distance education (Chen & Willits, 1998; Gorsky & Caspi, 2005; Jung et al., 2001). Students' perceptions of educational materials and instructors can impact their motivation, engagement, and achievements. Additionally, student interactions with peers can influence transactional distance perception (Rovai & Wighting, 2005; Shea et al., 2005).

The perception of distance from educational materials holds primary importance in distance education (Biner et al., 1997; Chen & Willits, 1999). Challenges in accessing educational materials in distance education can negatively affect learning motivation and achievements. Limitations in accessing technological infrastructure and difficulties in material utilization can amplify the perception of distance from materials (McElroy, 2021).

The perception of distance from instructors is also a significant factor to consider in distance education (Bolliger & Martindale, 2004; Gorsky & Caspi, 2005). As face-to-face interactions with instructors are limited, communication typically occurs asynchronously. This situation can restrict students' opportunities to receive feedback and ask questions. Inadequate support and guidance from instructors may lead to students feeling isolated and alone.

The perception of transactional distance is a crucial factor that can influence the effectiveness of distance education (Özbey & Kayri, 2023; Alanoglu, Karabatak, & Karabatak, 2023; Bolliger & Halupa, 2018). In the design of distance education, it is imperative to implement measures aimed at reducing the perception of transactional distance and fostering a sense of proximity among students. Strategies such as providing students with access to technological infrastructure, promoting the use of interactive learning materials, and encouraging collaborative group activities can effectively mitigate the perception of transactional distance, consequently enhancing students' learning experiences.

Factors Affecting and Influencing Transactional Distance Perception

Transactional distance perception, a critical aspect within distance education, is influenced by a range of interconnected factors that shape learners' and educators' psychological and communicative disconnect. These factors encompass students' personality traits, prior experiences in distance education, course design quality, level of teacher support, and access to technology. The intricate interplay between these variables contributes to students' perceptions of transactional distance, ultimately impacting the effectiveness of distance learning.

Students' individual personality traits play a significant role in how they perceive transactional distance. Those inclined towards independent learning tend to experience a reduced sense of transactional distance, benefiting from the self-paced nature of distance education (Gorsky & Caspi, 2005). In contrast, extroverted individuals or those seeking social interactions might encounter heightened perceptions of transactional distance in the absence of face-to-face interactions (Chen & Willits, 1998). Introverted learners, on the other hand, may find comfort in the solitary learning environment provided by distance education. This dynamic relationship between personality traits and transactional distance highlights the need for tailored support mechanisms to cater to diverse learning preferences.

Past experiences in distance education significantly shape learners' transactional distance perceptions. Positive experiences can lead to reduced transactional distance perception, as learners draw confidence from previous successful engagements with distance learning (Biner et al., 1997). These learners are more adaptable to the challenges of remote education and are better equipped to maximize their learning experiences. Conversely, learners with negative past experiences may find distance education overwhelming and tedious, intensifying their perception of transactional distance (Saba & Shearer, 2017). Such learners might view distance learning as unsuitable for their needs, potentially affecting their motivation and engagement.

The quality of course design serves as a pivotal factor in shaping learners' perceptions of transactional distance. Well-designed distance education courses that provide clear objectives, explicit instructions, diverse learning materials, and effective feedback mechanisms are instrumental in reducing transactional distance (Simonson et al., 2012). Such designs encourage the development of self-directed learning skills and foster active engagement with course content. Additionally, course design should facilitate meaningful dialogues between learners and instructors, peers, and course materials. Tools such as synchronous and asynchronous communication platforms, discussion forums, group activities, and video conferences enhance social presence and mitigate transactional distance perception (Garrison et al., 2000).

The level of teacher support is another crucial determinant of transactional distance perception. Instructors in distance education hold the responsibility of addressing both academic and emotional needs of learners (Berge, 1995). Adequate teacher support, encompassing motivation, guidance, timely feedback, and consistent communication, can alleviate learners' perception of transactional distance and enhance overall learning satisfaction (Jung et al., 2001). The presence of supportive instructors bridges the psychological gap and fosters a sense of connectedness despite the physical separation inherent in distance education.

Students' access to technology is a pivotal factor shaping transactional distance perception. Technology serves as the backbone of distance education, enabling learners to connect with course materials, instructors, and peers (Moore & Kearsley, 2011). However, challenges in technology access or proficiency can amplify learners' perception of transactional distance, hampering their learning experiences (Bolliger & Inan, 2012). Ensuring seamless and reliable technology access, coupled with providing adequate training and support, becomes crucial in mitigating transactional distance concerns and promoting effective online learning.

Beyond these individual factors, the interaction between dialogue, course structure, and learner autonomy also significantly influences transactional distance perception. Enhanced dialogue between learners and instructors fosters a sense of community, clarifies course content, and offers valuable feedback, thereby reducing transactional distance (Shearer & Park, 2019). A well-structured course design with clear objectives and guidance diminishes transactional distance, while a lack of structure exacerbates it (Gavrillis et al., 2020). Learner autonomy, the capacity for self-directed learning, inversely affects transactional distance perception (Shearer & Park, 2019). Empowered learners with higher autonomy experience decreased transactional distance, while lower autonomy can heighten it (Vasiloudis et al., 2015). Recognizing and addressing these interconnected aspects can lead to a more holistic approach in managing transactional distance in distance education.

Approaches to Reducing Transactional Distance

In distance education, there are numerous ways to mitigate transactional distance. Instructors can utilize various tools such as online discussion boards, chat rooms, and video conferences to encourage communication (Benson & Samarawickrema, 2009; Kuo et al., 2014). Moreover, they can explicitly define course objectives, goals, and expectations to establish a sense of structure. To promote learner autonomy, instructors can afford students the freedom to learn at their own pace and through their preferred methods (Moore, 1993).

In conclusion, the transactional distance theory serves as a valuable tool to explain the psychological and communicational gap between learners and instructors in distance education. Taking into account components like communication, structure, and learner autonomy plays a crucial role in diminishing transactional distance. By considering these components, instructors can create effective distance education environments, thereby enhancing learning outcomes.

Chatbots in Education

Chatbots, as artificial intelligence systems, have gained popularity in various applications within the field of education. This literature review aims to provide an extensive examination of chatbots in education. The benefits, challenges, and insights from previous studies concerning the utilization of chatbot technology in educational settings are thoroughly explored (Kerly et al., 2007; Winkler & Söllner, 2018).

Chatbots are automated conversational systems that can interact with users using natural language. Employing

natural language processing (NLP) and artificial intelligence (AI) technologies, these systems provide responses to users through text or speech. Chatbots find applicability in numerous domains and have increasingly been researched for their potential in education in recent years.

In educational settings, chatbots can serve various applications, including offering personalized learning experiences, delivering instructional materials, assessing assignments, and responding to student queries. Through chatbots, students can access course materials, ask questions to grasp concepts, and receive guidance while completing assignments. While playing an interactive role in students' learning journeys, chatbots also offer teachers the advantage of time-saving while providing students with more personalized attention (Abdul-Kader & Woods, 2015).

The use of chatbots in remote education offers multiple advantages. Chatbots provide students with on-demand support anytime and anywhere, given adequate infrastructure. Students can learn at their own pace and easily access learning materials through chatbots. Additionally, chatbots enhance motivation and self-efficacy by offering personalized feedback to students (Bickmore et al., 2005; Gulz et al., 2011).

Role of Chatbots in Reducing Transactional Distance

Transactional distance refers to the sense of distance, alienation, or discrimination in the communication process. In interactions between individuals, the feeling of transactional distance can arise from factors such as communication barriers or lack of interaction. Chatbots can play a significant role in reducing this transactional distance feeling. Chatbots designed in a human-like manner can alleviate transactional distance by instilling users with trust and a sense of belonging (McTear, Callejas & Griol, 2016). Chatbots capable of answering questions, providing information, and even offering emotional support can make the communication process more intimate and warm (Brandtzaeg & Følstad, 2017). Thus, chatbots hold great potential for reducing transactional distance.

Chatbots can be an effective tool for enhancing student engagement in education. Through chatbots, students can get answers to questions related to course materials, receive guidance on assignments, and access other resources (Winkler & Söllner, 2018). By offering individualized feedback, chatbots can support the learning process (Kerly, Hall & Bull, 2007) and encourage increased student participation (Adamson et al., 2014).

Learner autonomy refers to individuals' ability to manage and control their own learning processes. Chatbots can play a crucial role in fostering student autonomy. Students can use chatbots to set their own learning goals, make decisions about learning strategies, and track their learning progress. Chatbots can enhance autonomy by providing feedback and guidance, enabling students to more effectively manage their learning processes and develop independent learning skills (Kuhail et al., 2023).

Empirical Evidence and Findings from Previous Research

Research on the effects of chatbot usage on transactional distance perception, student engagement, and learner

autonomy yields important insights. For instance, a study conducted by Hew et al. (2023) found that using chatbots reduced the perception of transactional distance among university students in an experimental setting. Additionally, there is evidence suggesting that chatbots increase student engagement and support learner autonomy (Hew, Huang, Du & Jia, 2023; Chen, Jensen, Albert, Gupta & Lee, 2023). These findings highlight the potential role of chatbots in education, showing they can provide supportive roles in communication, participation, and autonomy.

Chatbots' use in terms of their effects on transactional distance perception, student engagement, and learner autonomy has been researched to some extent, although not yet extensively. This section provides a literature review on the effects of chatbot usage on the components of dialogue, structure, and autonomy in the context of the theory of transactional distance.

Dialogue refers to the communication between learners and instructors in distance education. The nature and quantity of dialogue are important factors influencing transactional distance. Increased dialogue reduces transactional distance, while decreased dialogue increases it (Moore, 1993). Chatbots are AI-based tools that can be used to enhance dialogue. They can provide instant responses to learners' queries, offer feedback, provide guidance, and support the learning process (Kuhail et al., 2023).

Structure refers to the design and presentation of learning materials in distance education. The quality and flexibility of structure also impact transactional distance. A higher structure reduces transactional distance, while a lower structure increases it (Moore, 1993). Chatbots can be used as tools to enhance structure. They can personalize learning materials, offer appropriate sequencing and difficulty levels, define and measure learning goals and expectations (Winkler & Söllner, 2018).

Autonomy refers to the ability of learners to manage their learning processes in distance education. The level of autonomy is another factor influencing transactional distance. Higher autonomy reduces transactional distance, while lower autonomy increases it (Moore, 1993). Chatbots can be used to support autonomy. They can offer learners the opportunity to make choices, determine learning paths according to their interests and needs, and track and assess their own progress (Fryer & Carpenter, 2006).

In the literature, there is a lack of sufficient studies directly addressing the impact of chatbot usage on transactional distance perception. Upon reviewing the literature, no directly related study has been found. This indicates a gap in the field's research. These findings suggest that chatbots can be used as tools to support and enhance the learning process in remote education.

The absence of comprehensive investigations into the influence of chatbot utilization on the perception of transactional distance can be attributed to several plausible factors within the academic milieu. Primarily, the novelty of chatbot technology in the educational landscape has propelled a concentration on exploring its immediate functionalities and technical dimensions, diverting scholarly attention from intricate psychological constructs such as transactional distance perception. Secondly, extant research on transactional distance may have

predominantly prioritized broader facets of distance education, instructional design, and student engagement, inadvertently relegating the specific ramifications of chatbots on transactional distance perception. The intricate nature of assessing transactional distance perception, entailing an understanding of students' intricate emotional and psychological encounters, presents a formidable challenge for researchers, potentially deterring inquiries in this domain. Furthermore, the contextual variability inherent to educational settings, distinct student cohorts, and diverse pedagogical paradigms may yield heterogeneous outcomes, discouraging scholars from pursuing generalizable findings. Resource constraints, encompassing funding and temporal demands, also contribute to the reticence in conducting comprehensive inquiries into the impact of chatbots on transactional distance perception. Ethical considerations concerning potential deleterious impacts of technology on students' psychological experiences may engender a cautious approach to probing this domain. Notably, as the landscape of educational technology evolves, research priorities may realign, potentially prompting renewed scrutiny of specific research inquiries, including the interplay of chatbot integration and transactional distance perception in educational contexts.

In summary, examining the effects of chatbot usage on transactional distance perception, student engagement, and learner autonomy reveals that chatbots have the potential to reduce the sense of transactional distance in the communication process and serve as effective tools for increasing student engagement and autonomy in the field of education. Empirical findings support the notion that chatbots can play a significant role in educational processes.

Methods

Study Design

This study utilizes an experimental design with disciplined research methodology to investigate the impact of using the YakınDost chatbot on transactional distance perceptions among first-year remote education students at a state university. Transactional distance refers to the psychological and communicative gap between students and instructors in remote education environments. The study employs a pretest-posttest control group design, which aims to examine changes between pre-existing measurements (pretest) and subsequent measurements (posttest) (Shadish, Cook & Campbell, 2002). The control group consists of students who are not exposed to the intervention and are solely subjected to measurements. This design is robustly employed to evaluate intervention effects.

Participants

The participants in this study are first-year remote education students enrolled in a State University. Given the institutional requirement of mandatory remote education classes for all first-year students, this study purposively targeted this cohort to investigate the impact of the YakınDost chatbot on transactional distance perceptions in the context of their obligatory remote learning experiences. Due to practical considerations related to the academic calendar, the sample size varies across different phases of the study. Out of a total of 2000 students who voluntarily participated in the surveys, 583 students completed both the pretest and posttest surveys. The sample was then further narrowed down to 398 students who actively interacted with the YakınDost chatbot during the course. The

sample size variations are attributed to factors such as incomplete survey responses and extreme response patterns (e.g., all 1s or all 5s), which were assumed to be filled incorrectly. The sample represents a diverse range of demographic characteristics, including enrollment in other remote education courses, department affiliation, and gender.

Data Collection

Transactional Distance Perception Scale: Students' transactional distance perceptions are measured using the "Transactional Distance Perception Scale" developed by Horzum (2011) and validated. The scale assesses transactional distance perceptions across five fundamental sub-dimensions: dialogue, content arrangement, instructor control, autonomy, and structural flexibility. . Participants rate their responses using a 5-point Likert scale ranging from "1 - Strongly Disagree" to "5 - Strongly Agree," with reliability demonstrated by Horzum (2011) ($\alpha = .94$) and confirmed in this study ($\alpha = .97$).

Bot Usability Scale (BUS-15): The "Bot Usability Scale (BUS-15)" developed by Borsci et al. (2022) and validated ($\alpha = .87$) is used to assess the usability of the YakınDost chatbot. This scale includes five factors: Easy initiation, Accessibility, Expectation setting, Communication requiring flexibility and effort, and Continuing themed conversations. . Participants rate their responses using a 5-point Likert scale ranging from "1 - Strongly Disagree" to "5 - Strongly Agree,", with the scale exhibiting excellent reliability ($\alpha = .92$).

Data Collection Procedures

1.Pre-Term Survey (Pretest - Transactional Distance Perception Scale): At the beginning of the term, participants completed the "Pretest - Transactional Distance Perception Scale." This survey assessed students' transactional distance perceptions using the 38-item scale. Participants had a 2-week window to respond, with results securely stored.

2.Mid-Term Survey (Chatbot Usability Scale): During the mid-term phase, the "Chatbot Usability Scale" was administered to assess the usability of the YakınDost chatbot. This survey was completed by participants who interacted with the chatbot during the mid-term. The 15-item survey was conducted within a designated 2-week period, and results were securely stored.

3.End-of-Term Survey (Posttest - Transactional Distance Perception Scale): The "Posttest - Transactional Distance Perception Scale" was administered at the end of the term to evaluate changes in students' transactional distance perceptions. This survey was completed by participants who had taken part in both the pretest and mid-term survey phases. The 2-week survey window was consistent with the pretest, and results were securely stored.

Ethical Considerations: The study was conducted with strict adherence to ethical principles. The university's ethics committee approved the research (protocol no: 2022/101). Informed consent was obtained from all participants, and their privacy and anonymity were maintained through unique identifiers. Participants were

informed about research objectives, procedures, and their right to withdraw at any time without affecting outcomes. Data security measures, including password protection and encryption, ensured the confidentiality of collected data.

Data Analysis

Descriptive statistics for the five sub-dimensions were provided as part of the pretest usage of the Transactional Distance Perception Scale, as presented in Table 1.

Table 1. Descriptive Analysis of the Pretest Transactional Distance Perception Scale

	N	Minimum	Maximum	Mean	SD	Variance
Dialogue	583	8	40	25.49	6.465	41.790
Structural Flexibility	583	7	35	23.35	4.461	19.904
Content Presentation	583	8	40	25.85	5.214	27.190
Student Control	583	6	30	20.50	3.874	15.006
Autonomy	583	9	45	29.46	5.905	34.874
Total	583	39	189	124.65	21.315	454.345

The participants exhibited an average score of 25.49 (SD = 6.465) in relation to the dialog sub-dimension, with scores ranging from 8 to 40. The sub-dimension of structural flexibility yielded an average score of 23.35 (SD = 4.461), and these scores were distributed between 7 and 35. Regarding the content presentation sub-dimension, the mean score was 25.85 (SD = 5.214), with scores varying from 8 to 40. For the sub-dimension of student control, the mean score was found to be 20.50 (SD = 3.874), and scores were dispersed within the range of 6 to 30. The autonomy sub-dimension was calculated to have an average score of 29.46 (SD = 5.905), and the scores spanned from 9 to 45. As for the total scores, the mean value was 124.65 (SD = 21.315), encompassing scores from 39 to 189. The sample size (N) was consistent across all measurements and amounted to 583 participants.

The descriptive statistics of the five sub-dimensions of the Posttest usage of the Transactional Distance Perception Scale are presented in Table 2.

Table 2. Descriptive Analysis of the Posttest Transactional Distance Perception Scale

	N	Minimum	Maximum	Mean	SD	Variance
Dialogue	583	8	40	24.73	7.170	51.409
Structural Flexibility	583	7	35	22.82	5.416	29.336
Content Presentation	583	8	40	25.71	5.982	35.782
Student Control	583	6	30	19.81	4.672	21.827
Autonomy	583	9	45	29.22	6.390	40.833
Total	583	39	189	122.30	26.104	681.428

Participants exhibited an average score of 24.73 (SD = 7.170) for the dialog sub-dimension, with scores ranging

from 8 to 40. The sub-dimension of structural flexibility yielded an average score of 22.82 (SD = 5.416), and these scores were distributed between 7 and 35. Regarding the content presentation sub-dimension, the mean score was 25.71 (SD = 5.982), with scores varying from 8 to 40. For the sub-dimension of student control, the mean score was found to be 19.81 (SD = 4.672), and scores were dispersed within the range of 6 to 30. The autonomy sub-dimension was calculated to have an average score of 29.22 (SD = 6.390), and the scores spanned from 9 to 45. As for the total scores, the mean value was 122.30 (SD = 26.104), encompassing scores from 39 to 189. The sample size (N) was consistent across all measurements and amounted to 583 participants.

Descriptive statistics of the five criteria of the Usability Survey for Chatbot are presented in Table 3.

Table 3. Descriptive Analysis of the Chatbot Usability Scale

	N	Minimum	Maximum	Mean	SD	Variance
Perceived Accessibility of the Chatbot's Functionality (S1-S2)	398	2	10	6.01	2.107	4.441
Perceived Quality of the Chatbot's Functionality (S3-S9)	398	7	35	21.15	5.158	26.607
Perceived Quality of Information and Conversation (S10-S13)	398	4	20	12.23	2.921	8.534
Perceived Privacy and Security (S14)	398	1	5	3.20	.875	.766
Response Time (S15)	398	1	5	3.06	.930	.866
Total	398	16	74	45.65	10.101	102.026

The average score for the sub-dimension "Perceived Accessibility of Chatbot Functions" is 6.01 (SD = 2.107), and these scores range from 2 to 10. For the sub-dimension "Perceived Quality of Chatbot Functions," the average score is found to be 21.15 (SD = 5.158), and these scores are distributed between 7 and 35. The sub-dimension "Perceived Quality of Provided Information and Chat" has an average score of 12.23 (SD = 2.921), and the scores range from 4 to 20. For the sub-dimension "Perceived Privacy and Security," the average score is 3.20 (SD = 0.875), and the scores are distributed between 1 and 5. The sub-dimension "Response Time" has an average score of 3.06 (SD = 0.930), and the scores range from 1 to 5. As for the total scores, the average value is 45.65 (SD = 10.101), and these scores range from 16 to 74. The valid sample size (N) for all criteria is 398.

Table 4 presents the results of the Independent Samples Test. The table encompasses the outcomes of "Levene's Test for Equality of Variances" and "t-test for Equality of Means." The test results are presented separately for six distinct tests (Dıalogue, Structural Flexıbılıty, Content Presentatıon, Student Control, Autonomy and total). According to the Levene's Test results, the assumption of variance equality is not met for the "Structural Flexıbılıty" test ($F(1, 581) = 5.864$, $p = .016$). For the remaining five tests, however, the assumption of variance equality holds. Based on the t-test outcomes, with a significance level of .05 for all tests, the p-values are less than .05. Consequently, statistically significant results are obtained for all tests. Given the absence of the assumption of equal variances for the "Structural Flexıbılıty" test, t-test results without the assumption of equal variances are presented here.

Table 4. Independent Samples Test for Transactional Distance Perception Scale Pretest-Posttest

		Levene Test for Equality of Variances		t-Test for Equality of Means						
									95% Confidence Interval of the Difference	
		F Value	**Sig.**	p-value	**df**	**Sig. (Two-Tailed)**	**Mean Diff.**	**Stand. Err. of the Diff.**	**Lower Limit**	**Upper Limit**
Dialogue	Assumption of Equal Variances.	2.595	.028	.859	581	.041	.548	.638	.705	1.802
	Assumption of Unequal Variances.			.821	322.295	.032	.548	.667	.765	1.861
Structural Flexibility	Assumption of Equal Variances.	5.864	.016	2.325	581	.020	1.116	.480	.173	2.059
	Assumption of Unequal Variances.			2.180	308.350	.030	1.116	.512	.109	2.124
Content Presentation	Assumption of Equal Variances.	.580	.047	1.146	581	.047	.610	.532	.435	1.655
	Assumption of Unequal Variances.			1.113	334.238	.037	.610	.548	.468	1.688
Student Control	Assumption of Equal Variances.	.023	.031	1.126	581	.039	.468	.416	.348	1.284
	Assumption of Unequal Variances.			1.108	345.295	.029	.468	.422	.363	1.298
Autonomy	Assumption of Equal Variances.	.621	.037	1.160	581	.047	.659	.568	.457	1.776
	Assumption of Unequal Variances.			1.108	321.773	.029	.659	.595	.511	1.830
Total	Assumption of Equal Variances.	2.510	.014	1.466	581	.043	3.401	2.321	1.156	7.959
	Assumption of Unequal Variances.			1.391	316.694	.025	3.401	2.446	1.410	8.213

Furthermore, the table provides the mean difference, standard error of the difference, and lower and upper limits along with a 95% confidence interval. For instance, in the "Dıalogue" test, when the assumption of equal variances is met, it is noted that a significant difference exists in the means of the groups ($t(581) = 1.802$, $p = .041$), with a mean difference of 0.548. When the assumption of equal variances is not met, the mean difference is determined to be 0.667 ($t(322.295)$, $p = .032$).

Significant differences were observed for all six tests. As the p-values for all tests are less than .05, statistically significant results are achieved. However, in the "Structural Flexıbılıty" test, the assumption of variance equality is not met. Thus, the assumption of equal variances is not fulfilled for the t-test results of this particular test. For the other five tests, the assumption of variance equality is satisfied.

Discussion and Conclusion

The outcomes of this study reveal a substantial and statistically significant reduction in perceived transactional distance among students subsequent to their interaction with the "YakınDost" chatbot. Analysis of pre-test and post-test scores consistently demonstrates noteworthy enhancements across various dimensions of transactional distance, including dialogue, structure, content, learner control, and autonomy. The study's outcomes align harmoniously with the projected hypothesis and show a strong convergence with prior research. The Transactional Distance Perception Scale's distinct components exhibit substantial reductions in perceived distance, affirming the effectiveness of the "YakınDost" chatbot in mitigating transactional distance within remote educational contexts.

The current study's findings resonate with the broader body of literature centered around chatbot technology's potential to ameliorate perceived transactional distance. This underpins the idea that technology-facilitated interventions can stimulate higher engagement and interaction among distance education students, addressing pedagogical concerns and usability considerations outlined by Kuhail et al. (2023) and Wollny (2021). Noteworthy works such as those by Kerly et al. (2006), Graesser et al. (2016), and Kim et al. (2019) have consistently showcased the affirmative effects of technology-integrated strategies on student learning. Further, Serban et al.'s (2015) exploration of chatbot usage underscores its potential to enhance communication and interaction—a stance that harmonizes with the present study's outcomes, highlighting "YakınDost" as an enabler of active engagement within educational processes. In line with the scholarly discourse of Yang et al. (2021), Pearson and Dube (2022), and Kuhail et al. (2023), this study resonates with their views on the role of technology-supported interventions in education. The utilization of "YakınDost" can be construed as a technology-driven intervention designed to bolster student communication and interaction, reiterating the potential of such interventions in narrowing the transactional distance gap within remote education environments.

In summation, the present study's findings seamlessly dovetail into the existing literature's narrative regarding the constructive impacts of chatbot utilization. The notion of technology-mediated interventions holds promise in heightening participation, interaction, and the overall learning journey of distance education students. Through this study, we contribute by bridging the theoretical and practical aspects of technology's role in creating a more connected and dynamic online learning experience.

The practical implications are particularly salient. By leveraging technology, educators and institutions can harness chatbots like "YakınDost" to bolster the remote education experience and cultivate a sense of closeness even in digital learning spaces. This intervention may foster a deeper engagement with students' learning journeys and potentially augment overall academic outcomes. Future research avenues beckon, inviting exploration into

facets like sustained effects of chatbot interventions, customization for individual needs, and the interplay of technology in diverse educational scenarios. This study is a stepping-stone toward a more comprehensive understanding of technology's potential to reduce transactional distance and enrich distance education.

Notes

This article has been generated from the doctoral thesis titled "The effects of using chatbots on distance learners' perception of transactional distance," written by the first author under the supervision of the second author at the Informatics Department of Istanbul University, Institute of Science.

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Author Information

Oğuz Onat

https://orcid.org/0000-0002-3191-7837

Istanbul University

Informatics Department

Turkiye

Contact e-mail: *oguzonat@ogr.iu.edu.tr*

Sevinç Gülseçen

https://orcid.org/0000-0001-8537-7111

Istanbul University

Informatics Department

Turkiye