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The Impact of Artificial Intelligence Applications on Linguistic and Literary Connections Among Turkic Peoples Based on Ethnocultural Codes

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Abstract: This research experimentally examined the effectiveness of artificial intelligence (AI) applications in teaching linguistic and literary connections among Turkic peoples, grounded in ethnocultural codes. Sixty-seven second-year undergraduate students at the Faculty of Literature of a state university in Kazakhstan participated in a quasi-experimental pre-test–post-test control-group design. The experimental group received a five-session instructional program integrating AI tools such as ChatGPT, Midjourney, and Voyant Tools, and the control group processed the same content using traditional methods. Data collection involved a self-developed achievement test (KR-20 = 0.89) and a Likert-type attitude scale (Cronbach $\alpha = 0.86$). The data were analyzed using ANCOVA, with pre-test scores as covariates. The findings revealed that AI-assisted instruction had a large, statistically significant effect on students' academic achievement ($F(1, 64) = 23.510$; $p < 0.05$; $\eta^2 = 0.27$). A significant difference was also found regarding the experimental group's attitudes towards the course ($F(1, 64) = 8.738$; $p < 0.05$; $\eta^2 = 0.12$). This effect was evaluated as moderate-large. The results show that AI tools support the transmission of ethnocultural content in Turkology education at both cognitive and affective levels, and that integrating these technologies with pedagogical designs grounded in cultural sensitivity can significantly contribute to the literature and practice.

Keywords: Turkology education, ethnocultural codes, Turkic peoples, AI-assisted instruction, academic achievement, attitude towards the course.

The study of language families worldwide is one of the fundamental ways to understand the historical, cultural, and identity processes of societies. The Turkish language family holds a special place in world linguistic literature due to its vast geographical spread and the presence of dozens of peoples within it. Linguistic commonalities among Turkic peoples are clear not

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only at the levels of vocabulary and phonology, but also in literary traditions, oral culture elements, and written sources (Dautuly et al., 2026; Johanson, 2021; Serdalina, 2024). These commonalities constitute a major area of interest in Turkology research.

Several scholars have conducted research on this topic. For example, Sjoberg (1993) examined the link between the linguistic structure and cultural identity of Central Asian Turkic peoples from a historical perspective, while Tikhomirov (2020) studied the ethnogenesis of Turkic peoples and interlinguistic commonalities. Rentzsch (2020) evaluated the modal structures in Turkic languages within a comparative framework. Dautuly et al. (2026) examined the influence of rhymes in the literature of Turkic peoples on ethnocultural codes, while Kaliyeva et al. (2025) addressed the ethnolinguistic nature of Kazakh mythological vocabulary. Serdalina (2024) traced the historical transformation of Kazakh and Turkic languages through the figure of Korkut Ata. Kurmangali et al. (2025) comparatively analyzed the impact of the national-cultural code on linguistic consciousness.

The expanding scope of Turkology research has led to questioning the methods of teaching language, expression, and literature. Gabdulkhakov and Yashina (2024) examined the integration of cultural sensitivity into educational processes, while Mussatayeva and Kakimova (2023) addressed the need to reflect ethnocultural identity in educational content. Valeh (2016) examined education and cultural policy in the Turkic world, while Fisekcioglu (2022) presented a concrete model for integrating cultural codes into language instruction in Turkish as a foreign language. As can be seen, education-based studies that address linguistic connections among Turkic peoples through the lens of ethnocultural codes remain quite limited.

Research that has addressed the subject with digital technologies includes Eshmamatova (2025) on parallel corpus applications of morphology generators for Turkic languages, Khamroyeva et al. (2025) on the digital infrastructure of corpus linguistics in Turkic languages, and Berdimuratov (2024) on the common cultural heritage of Turkic peoples. Regarding AI, Sadigova et al. (2025) examined its effects on sociolinguistics from a broad perspective. Guliyeva (2025) evaluated the application of AI to dialect research from a Turkology perspective. Xoliqova (2025) examined problems in translating Turkic color-based ethnic names. However, none of these studies has delved sufficiently deep into the subject of Turkology. In terms of AI and language education, Sultan et al. (2025) examined the relationship between AI literacy and intercultural communication competencies of philology students, and as seen, research examining the contribution of AI applications to the instructional transfer of these connections is very limited.

Linguistic and Literary Connections Among Turkish Public

The structural features of the Turkic language family reflect the common origin and long-term interaction among its languages (Johanson, 2021; 2023; Johanson & Csató, 2021). These commonalities are clearly evident at the phonological, morphological, and lexical levels, supporting the generally accepted linguistic thesis that Turkic languages originated from a single proto-Turkic source (Bekpenbetova et al., 2024; Tikhomirov, 2020). This proximity observed across modal categories, vocabulary, and morphological structure is a product of both linguistic and socio-cultural processes (Rentzsch, 2020; Sjoberg, 1993). Yama and Wasino (2025) argued that interlingual structural similarities are intertwined with ethnic and cultural identity

The deep-rooted nature of these structural commonalities has enabled literary connections among Turkic peoples to transcend mere linguistic heritage. The oral literary tradition, through its genres such as epics, fairy tales, rhymes, and riddles, concretizes this connection via structural and thematic parallels observed across different Turkic communities (Dautuly et al., 2026; Serdalina, 2024). Literary terminology and mythological vocabulary are further concrete indicators of this shared heritage. The interlinguistic proximity of literary terms

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in Turkic languages and the function of mythological narratives in carrying ethnocultural codes across generations indicate that this tradition plays a decisive role not only aesthetically but also in identity construction (Gayarovna Zubairova et al., 2016; Kaliyeva et al., 2025; Kurmangali et al., 2025).

The decisive role of literary tradition in identity construction is currently undergoing a transformation. In this process, where digitalization has radically reshaped research, digital tools such as corpus linguistics, morphology generators, and semantic processing technologies have significantly expanded the scope and methodological diversity of studies on Turkic languages (Eshmamatova, 2025; Khamroyeva et al., 2025; Xoliqova, 2025). Moreover, integrating AI into dialect research creates new opportunities and technical and ethical challenges that require solutions in this field (Guliyeva, 2025; Uzun et al., 2026). All these developments clearly demonstrate the need for original methods for researching and transmitting the linguistic and cultural heritage of Turkic peoples in the digital age and show that this heritage is part of a dynamic process that carries its vitality not only into the past but also into the future (Berdimuratov, 2024).

Ethnocultural Codes and Content Transfer in Turkology Education

Ethnocultural codes are defined as symbolic units of meaning that transmit a society's cultural identity, value system, and worldview through language and are reproduced across generations (Gabdulkhakov & Yashina, 2024). This broad spectrum, ranging from word choice to idiomatic structures, proverbs to mythological narratives, reflects the grammatical dimension of a language and its cultural and epistemological depth. The elements through which ethnocultural identity is expressed in different Turkic communities (Mussatayeva & Kakimova, 2023), the overlapping and diverging dimensions of cultural code structures in the context of Kazakh and Turkish (Kurmangali et al., 2025), and the function of mythological vocabulary as a carrier of these codes (Kaliyeva et al., 2025) have been examined in detail in the literature. The preservation and transmission of ethnocultural values is not only a cultural necessity but also of strategic importance regarding education and arts policies (Huseynova et al., 2025; Valeh, 2016). In this context, reflecting cultural sensitivity in education is a multifaceted process that must be considered from both pedagogical and ethical perspectives (Gabdulkhakov & Yashina, 2024).

When integrating ethnocultural codes into Turkology education, content transfer cannot be limited to grammatical knowledge alone. Including cultural reference points and the symbolic layers of meaning specific to Turkic peoples in the teaching process enables students to grasp not just a language but the cultural world of the society that speaks it. In this regard, the concept of language worldview and the action-oriented national folklore approach offer a unique model for systematically integrating cultural code into teaching content (Fisekcioglu, 2022). The use of oral culture elements, such as rhymes, as teaching materials supports both cultural awareness and language acquisition (Dautuly et al., 2026), while the inclusion of shared cultural values, such as Korkut Ata, in teaching processes further reinforces this potential (Serdalina, 2024). Digital learning environments are increasingly playing a strategic role in the transmission of ethnocultural values. Empirical evidence shows that AI literacy and cultural literacy support each other (Sultan et al., 2025). Reviving the common cultural heritage of Turkic peoples in educational settings remains a goal of both social and academic value (Berdimuratov, 2024).

Yet the pedagogical challenge of transmitting ethnocultural codes goes beyond identifying appropriate content; it equally concerns the methods through which that content can be made accessible, interactive, and cognitively engaging for contemporary learners. Traditional instructional approaches, centered on lecture and printed materials, have limited capacity to render the layered symbolic meanings of Turkic oral traditions — epics, proverbs,

mythological narratives — in ways that invite active interpretation rather than passive reception (Fisekcioglu, 2022; Gabdulkhakov & Yashina, 2024). AI-powered tools, by contrast, offer multimodal environments in which students can query, visualize, and comparatively analyze cultural content in real time, thereby transforming ethnocultural material from static subject matter into a dynamic object of inquiry. It is precisely this affordance — the capacity to make culturally dense, symbolically rich content interactable — that positions AI not merely as a technological upgrade to existing Turkology pedagogy, but as a structurally different medium for the transmission of ethnocultural codes (Berdimuratov, 2024; Sultan et al., 2025).

Artificial Intelligence-Supported Teaching Applications in Turkology Education

The integration of AI technologies into language teaching has rapidly developed in recent years, with a greater diversity of applications and greater intensity of research. This broad spectrum, ranging from automated assessment systems and intelligent tutoring applications to natural language processing tools and personalized learning platforms, is fundamentally transforming traditional approaches to language teaching. The effectiveness of AI in language assessment processes has been demonstrated empirically (Aydin et al., 2025; Du & Daniel, 2024). Research on English language learning has shown that AI-assisted instruction provides significant advantages over traditional methods in terms of learning success, second-language motivation, and self-regulated learning (Law, 2024; Wei, 2023). Systematic review studies have also comprehensively documented general trends and research gaps in this field (Purba et al., 2025). The positive effects of interactive tools such as chatbots and AI tutors on student motivation and learning behaviors are strongly supported in the literature (Azamatova et al., 2023; Koka, 2024; Otermans et al., 2026; Solak & Lok, 2026). Besides, research from a teacher's perspective reveals that alongside expectations for this technology, there are also significant concerns, highlighting that the integration of AI into language education should be addressed not only from a technical standpoint but also from pedagogical and humanistic perspectives (Alas & Pehlivan, 2025).

In the specific context of Turkology education, the use of AI applications presents a distinct situation due to the technical requirements of language teaching and the unique structural characteristics of Turkic languages and cultures. The morphological richness, dialectal diversity, and ethnocultural code density of Turkic languages make the adaptation of AI tools to this field a research and design issue in itself. The capacity of AI-based natural language processing systems to recognize the diversity of Turkic dialects poses a problem that requires careful consideration arising from technical limitations and ethical and pedagogical perspectives (Guliyeva, 2025; Uzun et al., 2026). The use of morphology generators alongside parallel corpus applications provides a concrete model for integrating instructional technology with the structure of the Turkic language (Eshmamatova, 2025).

Research conducted within the context of teaching Turkish as a foreign language reveals that digital assessment tools make valuable contributions to the process for both teachers and students (Demirkol & Sofu, 2025), while the integration of AI into Turkish language education policies is also emerging as a separate research agenda (Ermagan & Ermagan, 2022). This integration should be addressed not only at the technical level but also in professional and identity-related dimensions. The transformative effect of AI on sociolinguistic dynamics remains another layer on the agenda of Turkology research (Sadigova et al., 2025). Clearly, a comprehensive, contextually sensitive framework, both technical and pedagogical, is needed to support AI tools for the transmission of ethnocultural codes in Turkology education.

The theoretical foundation of the current research rests on the convergence of constructivist learning theory, project-based learning, and multimedia learning principles. Constructivist approaches posit that learners construct knowledge actively through interaction with meaningful content embedded in authentic cultural contexts, rather than through passive

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reception of information (Fisekcioglu, 2022). In this framework, ethnocultural codes function not merely as subject matter but as epistemologically rich material through which students co-construct an understanding of shared Turkic heritage. Building on this foundation, the project-based learning approach adopted in the experimental instruction — in which students engaged in AI-assisted inquiry, comparative analysis, and visual representation tasks — is consistent with evidence demonstrating that integrating AI and digital tools within project-based designs significantly enhances achievement and motivation in language learning contexts (Azamatova et al., 2023).

Furthermore, the multimodal nature of the instructional design, which incorporated text-based AI generation (ChatGPT), visual synthesis (Midjourney), and corpus analysis (Voyant Tools), aligns with the principle that learning is deepened when verbal and visual channels are activated simultaneously (Wei, 2023). The integration of AI literacy with cultural content transmission also draws theoretical support from Sultan et al. (2025), who demonstrated that familiarity with AI tools strengthens students' engagement with culturally embedded academic content. Together, these theoretical perspectives explain why AI-assisted instruction, rather than functioning as a mere technological substitute for traditional methods, constitutes a qualitatively different pedagogical environment that supports deeper cognitive processing and affective engagement with ethnocultural content.

Research Objective and Research Questions

The current research aims to determine the effectiveness of AI applications in teaching linguistic and literary connections among Turkic peoples based on ethnocultural codes. Based on an experimental research design, it will allow for the scientific testing of whether AI-assisted instruction creates a significant difference in students' academic achievement and attitudes towards the subject of "linguistic and literary connections among Turkic peoples based on ethnocultural codes" compared to traditional instruction. The findings are expected to make significant contributions to the literature on the use of digital technologies in Turkology education. In line with this general aim, the research seeks to answer the following questions:

- Is there a significant difference in academic achievement between the experimental group, which used AI applications, and the control group, which received traditional instruction, regarding the topic of "linguistic and literary connections among Turkic peoples based on ethnocultural codes"?
- Is there a significant difference between the experimental group, which used AI applications, and the control group, which received traditional instruction, regarding students' attitudes towards the topic of "linguistic and literary connections among Turkic peoples based on ethnocultural codes"?

Method

Research Design

This research is an experiment aimed at determining the effectiveness of an AI-assisted teaching method for teaching linguistic and literary connections among Turkic peoples based on ethnocultural codes. A quasi-experimental pre-test–post-test control-group design was used. This design allows testing the effect of experimental intervention. It is the most suitable model given the need to work with pre-formed groups in educational settings (Creswell & Creswell, 2018). The independent variable in the study is the teaching method, with two levels: AI-assisted instruction (experimental group) and traditional instruction (control group). The dependent variables are the students' academic achievement levels regarding the ethnocultural

codes of Turkic peoples and their attitudes towards the course. In the quasi-experimental design, a pre-test was administered to both groups before the experimental intervention. The experimental intervention was then applied only to the experimental group. At the end of the process, a post-test was administered to both the experimental and control groups to examine group differences. Table 1 shows the study's experimental design.

Table 1
Quasi-Experimental Pre-Test–Post-Test Research Design of the Study

Groups	Pre-Test	Treatment	Post-Test
Group 1 (Experimental)	Attitude Scale / Achievement Test	AI-Assisted Instruction	Attitude Scale / Achievement Test
Group 2 (Control)	Attitude Scale / Achievement Test	Traditional Instruction	Attitude Scale / Achievement Test

Participants

The study group comprised 67 second-year undergraduate students at the Faculty of Literature of a state university in Kazakhstan, as they possess a fundamental academic background in Turkology and comparative literature. This background ensures that the research topic is meaningful and contextually appropriate for the students.

The study group was selected using purposive sampling. Two departments within the institution were randomly assigned as experimental and control groups. The experimental group consisted of 33 students, while the control group consisted of 34 students. Eighteen students in the experimental group were female, and 15 were male; in the control group, 19 were female, and 15 were male.

To verify the initial equivalence of the groups, the students' previous-semester grade point averages and overall academic achievement levels were compared, and no significant difference was found between the two groups. Furthermore, the results of the independent samples t-test conducted during the pre-test phase statistically confirmed that the groups exhibited a balanced distribution of achievement and attitude pre-test scores.

Data Collection Tools

Achievement Test

The researchers developed an achievement test used to cover the linguistic and literary connections and ethnocultural codes of Turkic peoples. During test preparation, textbooks and academic resources used in Kazakhstan and the Turkic world were thoroughly reviewed. Then, a specification table was created to determine the learning outcomes to be measured, and a pool of 30 items were developed. To ensure content validity, expert opinions from the fields of Turkology, Folklore, and Measurement and Evaluation were sought. Necessary corrections were made in line with expert suggestions. Based on analyses of pilot-phase data, the final test was reduced to 15 items, comprising multiple-choice and open-ended questions.

To ensure scoring consistency across item types, a detailed scoring rubric was developed for the open-ended items before data collection. Two independent raters scored a random subset of 20% of the open-ended responses; inter-rater agreement was calculated and found to be acceptable, confirming the reliability of the scoring process.

To assess the test's reliability, the KR-20 coefficient was calculated. The obtained value was 0.89. This value indicates that the instrument has high internal consistency. Item difficulty indices (p) and discrimination indices (r) were calculated for all 15 items during the pilot phase;

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items with difficulty indices below .20 or above .80, and those with discrimination indices below .30, were revised or excluded before finalizing the test. The resulting item pool demonstrated adequate psychometric properties, supporting the instrument's construct validity alongside the content validity evidence obtained through expert review. The achievement test was administered simultaneously and under identical conditions to both the experimental and control groups during the pre-test and post-test phases.

Attitude Scale

Researchers developed a Likert-type attitude scale to measure students' attitudes towards the topic of "Literature and Cultural Codes of Turkic Peoples." In the scale development process, attitude items containing positive and negative statements were first created in line with the relevant literature and the scope of the subject. To determine the content validity of the items, an expert panel consisting of two PhD-holding faculty members in the field of Kazakh Literature and an academician with a PhD in Measurement and Evaluation was consulted. After obtaining expert opinions, the necessary adjustments were made, and the scale was transformed into a pilot application form. Exploratory factor analysis of pilot study data from 158 individuals revealed a single-factor structure explaining an acceptable level of total variance. The Cronbach's alpha reliability coefficient, used to assess the scale's internal consistency, was 0.86, indicating that the scale is sufficiently reliable. The scale, consisting of 16 items in a 5-point Likert format, was administered to both the experimental and control groups in pre-test and post-test phases. See the Appendix.

Experimental Procedure

The research process was planned and implemented across eigh sessions, spanning the dates from November to January. In the first session, both groups administered a pre-test, an achievement test, and an attitude scale simultaneously. Before the administration, students were informed about the purpose and process of the research and signed voluntary participation forms. The groups were statistically equivalent at baseline, as confirmed by an independent-samples t-test comparing pre-test scores. Between the second and fifth sessions, the experimental group received an AI-assisted instruction program. The control group continued with traditional teaching methods during the same period. In the seventh and final session, the achievement test and attitude scale were administered as post-tests to both groups under the same conditions as the pre-tests. The data collected were prepared for analysis to serve as a basis for intergroup comparisons.

Experimental Group

The AI-assisted instruction program implemented in the experimental group consisted of five sessions, each lasting 90 minutes. AI tools such as ChatGPT, Midjourney, and Voyant Tools were actively used throughout these sessions. In the first session, students were introduced to the concept of ethnocultural codes in detail. The common meanings of symbols such as the wolf, tree, and water in Turkish mythology among different Turkic tribes were discussed using a comparative approach. This session also focused on effective prompt engineering techniques for large language models, and students conducted their first applications using ChatGPT to explore the common meanings of the wolf motif in Anatolian and Altai epics. In the second session, linguistic connections among Turkic dialects were examined using AI, with a focus on proverbs and idioms. Selected proverbs from Kazakh, Kyrgyz, Turkish, and Azerbaijani Turkish were analyzed comparatively.

In the third session, selected texts from the fundamental literary heritage of the Turkic world, such as the Dede Korkut Stories, the Manas Epic, and Alpamish, were analyzed using AI. Common epic motifs, such as the hero's birth, the sacredness of the horse, and the descent into the underworld, were examined comparatively. Furthermore, these mythological elements were visualized within the aesthetics of steppe art through Midjourney. In the fourth session, a corpus of Turkic fairy tales was analyzed using text-mining tools, including Voyant Tools. The most frequently used concepts and their co-occurrence frequencies were examined, and the data were then interpreted by AI to explore the binary opposition system (good-evil, earth-sky, white, black) in Turkic mythology. In the fifth and final session, students developed small-scale projects using the knowledge and skills acquired in the previous sessions and presented them in class. These projects were carried out under three main headings: linguistics-focused, literature-focused, and comparative.

Control Group

In the control group, the same subject matter—linguistic and literary connections and ethnocultural codes among Turkic peoples—was taught using traditional teaching methods. No AI applications were used in this process. Instruction was entirely instructor-centered, conducted through the whiteboard, photocopied readings, and printed visual materials. Students were introduced to basic ethnocultural concepts, symbols in Turkic mythology were explained, and proverbs and short folk literature texts compiled from different Turkic dialects were distributed. Students were asked to read these texts, look up unfamiliar words in dictionaries, and identify common motifs. Additionally, students were grouped into four. They were expected to prepare a research assignment on a cultural motif or literary genre of a Turkic people of their choice. In the final stage of the process, a comprehensive review was conducted, and students took a classic written exam covering the course content. In the control group, technological tools were used only at a basic level. Active student participation was kept to a limited extent.

Data Analysis

The data obtained were analyzed using the SPSS statistical package program. Arithmetic mean, standard deviation, and corrected mean values were calculated for the pre-test and post-test scores of both groups. The Shapiro-Wilk test and skewness and kurtosis coefficients were used to assess whether the data followed a normal distribution. It was observed that the achievement and attitude measures met the assumption of normal distribution. An independent-samples t-test was used to determine whether the pre-test scores of the groups were equivalent. One-Factor Analysis of Covariance (ANCOVA), with pre-test scores as covariates, was used to test differences in post-test achievement and attitude scores. This method allows for directly testing the independent effect of the experimental treatment by statistically controlling the effect of pre-test scores on the post-test. In cases where significant differences were detected, the effect size partial eta squared (η^2) value was calculated to evaluate the practical significance of the findings and interpreted according to Cohen's (1988) classification. The homogeneity of regression slopes assumption, which is a prerequisite for ANCOVA, was also tested and confirmed before analysis. Although the pre-test covariate did not reach statistical significance ($p = .396$), its inclusion as a covariate remains methodologically justified: in quasi-experimental designs, ANCOVA with pre-test scores is recommended as a standard procedure for reducing error variance and increasing statistical precision, regardless of whether baseline group differences are statistically significant (Creswell & Creswell, 2018).

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Ethical Considerations

Academic and professional ethical principles were fully adhered to throughout the research process. Necessary permissions were obtained from the ethics committee of the relevant university before the study commenced. Voluntary informed consent forms were signed. Participation in the research was voluntary, and students were provided with sufficient information about its purpose, process, and potential impacts. Students' identities were kept confidential throughout data collection and analysis. Data was de-identified, coded, and used just for research purposes. The results were reported impartially and transparently in accordance with scientific ethical rules.

Results

This section presents findings organized to answer two fundamental research questions. The findings include analyses of pre-test equivalence between the groups, ANCOVA results for post-test achievement scores, and ANCOVA results for post-test attitude scores. To examine the impact of AI applications on students' academic achievement, the pre-application achievement scores of the experimental and control groups were compared. Table 2 presents the findings from the pre-test, administered simultaneously to both groups.

Table 2 shows that the mean achievement test scores of the experimental and control groups did not differ significantly before the experimental intervention. The independent samples t-test revealed no statistically significant difference between the two groups ($t = -0.976$; $p = 0.333 > 0.05$). This finding confirms that both groups had similar distributions of achievement scores before the research procedures.

Table 2
Comparison of Pre-Test Achievement Scores

Pre-Test	Group	N	Mean	Std. Deviation	-t-	p
Achievement	Experimental	33	7.39	1.90	-0.976	0.333
	Control	34	7.82	1.70		

Table 3 shows that the mean attitude scale scores of the experimental and control groups did not differ significantly before the experimental intervention. The independent samples t-test revealed no statistically significant difference between the two groups ($t = 1.322$; $p = 0.191 > 0.05$). This finding indicates that the groups showed similar distributions of attitude scores before the intervention. The statistical confirmation of equivalence between the groups in the pre-tests suggests that pre-existing group differences were unlikely to account for post-intervention outcomes; however, given the quasi-experimental design and the presence of uncontrolled variables, such as instructor differences and potential novelty effects, causal attribution to the teaching method alone should be interpreted with caution. For the comparison of post-test scores, Analysis of Covariance (ANCOVA) was preferred because the baseline scores were used as a covariate.

Table 3
Comparison of Pre-Test Attitude Scores

Pre-Test	Group	N	Mean	Std. Deviation	-t-	p
Attitude	Experimental	33	3.48	0.46	1.322	0.191
	Control	34	3.65	0.59		

As shown in Table 4, the mean raw post-test achievement score was 12.70 for the experimental group and 10.76 for the control group. When pre-test achievement scores were controlled for as covariates, the adjusted mean scores were 12.72 for the experimental group and 10.74 for the control group. This pattern indicates a significant difference in achievement in favor of the experimental group after the intervention.

Table 4
Descriptive Statistics and Adjusted Means — Post-Test Achievement

Group	Mean	Std. Deviation	Adj. Mean
Experimental (1)	12.70	1.468	12.72
Control (2)	10.76	1.810	10.74

The statistical significance of this difference was tested using an ANCOVA, and the results are presented in Table 5 below. When the ANCOVA results in Table 5 are examined, it is seen that, when pre-test achievement scores are controlled as a covariate, there is a statistically significant difference between the experimental and control groups in post-test achievement scores ($F(1, 64) = 23.510$; $p = 0.000 < 0.05$). The partial eta-squared, an indicator of effect size, was $\eta^2 = 0.27$, indicating a large effect according to Cohen's (1988) classification. This finding reveals that students in the experimental group who participated in AI applications performed significantly better on post-test achievement scores than students in the control group who continued with the traditional teaching program.

Table 5
ANCOVA Results — Post-Test Achievement

Source	Type III SS	df	Mean Square	F	p	Partial η^2
Corrected Model	64.52	2	32.26	11.793	0.000	0.27
Intercept	417.15	1	417.15	152.480	0.000	0.70
Achievement (Pre-Test)	2.00	1	2.00	0.731	0.396	0.01
Group	64.32	1	64.32	23.510	0.000	0.27
Error	175.09	64	2.74			
Total	9437.00	67				
Corrected Total	239.61	66				

As shown in Table 6, the mean raw post-test attitude score was 4.04 for the experimental group and 3.54 for the control group. When the pre-test attitude scores were controlled for as covariates, the adjusted mean scores were 4.06 for the experimental group and 3.52 for the control group. This pattern indicates a significant difference in attitude scores in favor of the experimental group after the intervention.

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Table 6
Descriptive Statistics and Adjusted Means — Post-Test Attitude

Group	Mean	Std. Deviation	Adj. Mean
Experimental	4.04	0.83	4.06
Control	3.54	0.65	3.52

The statistical significance of this difference was tested using ANCOVA; the results are presented in Table 7. When the ANCOVA results in Table 7 are examined, with pre-test attitude scores controlled as a covariate, there is a statistically significant difference between the experimental and control groups in post-test attitude scores ($F(1, 64) = 8.738$; $p = 0.004 < 0.05$). The partial eta-squared value, an indicator of effect size, was $\eta^2 = 0.12$, corresponding to a medium-to-large effect size. This finding reveals that the experimental group students who participated in AI applications showed a significantly more positive attitude towards the course than the control group students who continued with the traditional teaching program.

Table 7
ANCOVA Results — Post-Test Attitude

Source	Type III SS	Df	Mean Square	F	p	Partial η^2
Corrected Model	5.38	2	2.69	4.855	0.011	0.13
Intercept	11.82	1	11.82	21.313	0.000	0.25
Attitude (Pre-Test)	1.17	1	1.17	2.105	0.152	0.03
Group	4.84	1	4.84	8.738	0.004	0.12
Error	35.49	64	0.55			
Total	1003.08	67				
Corrected Total	40.87	66				

Discussion

This research experimentally examined the effect of AI-assisted instruction on academic achievement and attitudes toward the course, compared to traditional instruction, in teaching linguistic and literary connections among Turkic peoples based on ethnocultural codes. The findings show that AI applications have a statistically significant and positive effect on both dependent variables. These results demonstrate that digital technologies can support the transmission of ethnocultural content in Turkology education. However, the experimental treatment comprised an integrated pedagogical package — combining AI tools (ChatGPT, Midjourney, Voyant Tools) with project-based learning and visualization activities — rather than an isolated AI intervention; accordingly, the observed effects reflect the cumulative impact of this design rather than the contribution of any single component.

Interpretation of the Findings

The findings obtained within the scope of the first question of the research reveal that the academic achievement of the experimental group students, who used AI applications, on the subject of "linguistic and literary connections among Turkic peoples based on ethnocultural

codes," is significantly higher compared to the control group students who received traditional instruction. Even after controlling for pre-test scores, this difference remained statistically significant in favor of the experimental group. This indicates that the effect of the applied AI-assisted instruction on achievement occurs independently of the baseline level. Moreover, this finding shows that the individualized feedback, interactive content presentation, and self-paced learning opportunities provided by AI tools significantly increase academic gain.

These results align with those of others. For example, Wei (2023) examined the effects of AI in language teaching and found that AI-assisted teaching environments yield better achievement outcomes than traditional methods. Similarly, Purba et al. (2025) found that AI-assisted learning interventions support cognitive gains. Koka (2024) determined that AI chatbots positively affect student performance in linguistics courses (Althaus et al., 2024).

The current study also confirms the functionality of these tools across different language-learning contexts. When evaluated in the context of Turkology, Demirkol & Sofu (2025) showed that AI-supported tools such as Socrative contribute to assessment processes in Turkish language teaching, indicating that AI can be used effectively not only for information transmission but also for measuring learning outcomes. The findings of the current research show that presenting ethnocultural content through AI tools deepens students' knowledge levels regarding linguistic and literary connections among Turkic peoples and facilitates their more lasting assimilation of this content (Gülçiçek, 2021).

The findings obtained within the scope of the second question of the research reveal that the attitudes of the students in the experimental group, who used AI applications, towards the topic of "linguistic and literary connections among Turkic peoples based on ethnocultural codes," followed a significantly more positive course compared to the students in the control group. This finding indicates that AI-assisted instruction positively affects not only cognitive gains but also students' emotional and behavioral tendencies towards the course. One reason is that the relationship students establish with interactive, visual, and multimedia-based content reinforces their interest and curiosity towards the course.

This finding aligns with the results of several other studies. Solak and Lok (2026) examined the effect of AI instructors on the motivation and learning behaviors of language learners. They empirically demonstrated that these tools strengthened students' positive attitudes towards the course. Wei (2023) also examined the effects of AI on second-language motivation and self-regulated learning. They revealed that technology-supported environments increased students' commitment to the course. Zheng et al. (2025) examined the relationship between attitudes toward AI-assisted language learning and academic intention. They found that attitudes became significantly more positive with the use of AI. Sultan et al. (2025) examined the relationship between AI l and cultural literacy among philology students. Interestingly, their study revealed that students accustomed to AI use had more positive attitudes toward cultural content. In this context, the present research finds that presenting ethnocultural code content in Turkology courses using AI tools significantly increases students' interest, curiosity, and willingness to participate (Chakma, 2026).

Implications of the Findings

The findings of this research contribute theoretically and practically to the literature on Turkology education. At the theoretical level, empirical evidence shows that AI-assisted instruction can be effectively used not only in general language learning but also in specialized areas that require cultural depth, such as ethnocultural code content. This finding makes a significant contribution to theoretical explorations of educational models that combine technology-assisted instruction with the transmission of cultural identity. These findings, which demonstrate that AI technologies can be integrated with the language-worldview approach

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proposed by Fisekcioglu (2022), lay the groundwork for restructuring the theory of Turkology teaching.

From an applied perspective, the research provides a basis for Turkology curriculum designers and implementers to effectively use AI tools in the transmission of ethnocultural content. This perspective supports the idea that oral literature elements, identified by Dautuly et al. (2026) and Kaliyeva et al. (2025) as carriers of ethnocultural codes, can be presented in more accessible and interactive forms through AI-supported platforms. The contribution of AI tools to assessment processes, also documented by Demirkol and Sofu (2025), shows that teachers can benefit from these technologies in both content teaching and student progress tracking. In addition, the findings reveal that digital transformation in Turkish language education should be positioned not as a necessity but as an opportunity.

Limitations

This research has several limitations, which should be considered when interpreting the findings. First, because the research was conducted with second-year students in the Faculty of Literature at a single state university in Kazakhstan, the findings cannot be generalized to other institutions, student profiles, or countries. Second, the quasi-experimental design of the research means that participants were not randomly assigned to groups, making it difficult to fully control for potential latent variables. Third, the eight-week experimental process makes it impossible to evaluate the long-term effects of AI-assisted instruction. Different results may be obtained in longer-term applications. Fourth, the fact that different instructors taught the experimental and control groups constitutes a meaningful methodological limitation. Instructor-related variables — including pedagogical style, enthusiasm, and familiarity with the subject matter — may have independently contributed to observed differences in student achievement and attitudes, making it difficult to attribute outcomes only to the instructional method. This limitation is consistent with the broader challenge of instructor effects in quasi-experimental educational research. It should be considered a competing explanation when interpreting the findings. Fifth AI's limited performance on Kazakh and Turkic dialects suggests that students in the experimental group may have encountered technological difficulties during some activities. Sixth, individual differences in students' access to AI tools and technological proficiency may have partially affected the experimental process. Seventh, the use of self-report scales to assess students' attitudes and innovation skills introduces potential measurement errors, such as social desirability bias. Eighth, because the researchers determined the content and format of the AI applications in the experimental group, the reproducibility of the results with different tool choices or application methods is questionable. Finally, the standardization level and quality of the traditional teaching process used in the control group could not be fully controlled during the research, which can make interpreting intergroup comparisons difficult.

Thus, the limitations indicate that the findings should be evaluated with care and in a context-sensitive manner. They also present important areas for methodological improvement for future research. Additionally, because the experimental treatment involved multiple simultaneously applied components — AI tools, project-based tasks, and multimodal visualization activities — it is impossible to isolate the independent contribution of any single element to the observed outcomes. Future research employing dismantling designs could address this limitation.

Recommendations

When research findings and existing limitations are considered together, it is possible to develop recommendations for practitioners and future researchers. In terms of application, Turkology educators should actively use AI tools not only for grammar instruction but also to

process linguistic and literary connections among Turkic peoples within the framework of ethnocultural codes. In this process, it is crucial for educators to consider the depth of content specific to Turkic languages and cultures when selecting AI tools and to integrate these tools consistently with the existing curriculum framework. Furthermore, in curriculum development processes, AI-supported activities should be positioned alongside traditional teaching elements to complement each other. The misconception that any single approach is sufficient should be avoided.

Planning short orientation sessions at the start of lessons to support students' readiness to use AI tools can also enhance the application's effectiveness. For future research, conducting repeat studies with larger, more diverse samples in countries where different Turkish languages and cultures are spoken is critical for testing the generalizability of the findings. Adopting longitudinal designs that can track long-term effects is a priority research requirement for revealing the sustainable impact of AI-assisted instruction on lasting learning outcomes and attitude change. In addition, comparative studies examining the effect sizes that vary by type, content format, and interaction patterns of AI applications can make significant contributions to theoretical and applied knowledge in this field.

Conclusion

This research experimentally tested the effectiveness of AI-assisted instruction in transmitting ethnocultural code content in Turkology education, filling a gap in the literature in this field. The findings reveal that AI applications have a significantly greater effect on both academic achievement and attitudes towards the course than traditional teaching. This result demonstrates that technology integration can serve as a tool for teaching linguistic and literary connections among Turkic peoples through ethnocultural codes. The research presents one of the first empirical studies regarding AI, ethnocultural code transmission, and Turkology education, a topic not previously addressed experimentally in the literature. Furthermore, the study serves as a practical guide for the effective use of AI tools in designing the Turkology curriculum. Thus, the research offers an integrated and original contribution to both the technology-assisted language teaching literature and the literature on Turkish cultural heritage education.

Informed Consent form

Informed consent was obtained from all participants involved in the study prior to their participation.

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Authors Contributions

R.K and S.T. conceptualized the study, led the design of the training program, and recruited participants. All authors contributed to the design of the research instruments and the training program. A.K. and G.M. conducted the pilot study with participants, performed the

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data analysis, and drafted the manuscript. Z.B. coordinated the research team and managed all correspondence with the journal. M.B. and S.T. reviewed and edited the manuscript. All authors read and approved the final version of the manuscript

Institutional Review Board Statement

This study comprised with established ethical standards for research involving human participants. Prior to data collection, it underwent internal ethical review and was granted expedited approval, as it presented minimal risk and involved voluntary, anonymous participation. Participants were informed of the study's objectives, their right to withdraw at any stage and the assurance of confidentiality. No personally identifiable information was gathered, and all data was used solely for academic and research purposes.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data is not publicly available due to privacy or ethical restrictions.

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Appendix

Attitude Scale Towards the Course "Literature and Cultural Codes of Turkic Peoples"

This scale was developed to determine the attitudes of second-year students at the Faculty of Literature of a university in Kazakhstan towards the course "Literature and Cultural Codes of Turkic Peoples". The scale is a 5-point Likert-type scale (1=Strongly Disagree, 2=Disagree, 3=Undecided, 4=Agree, 5=Strongly Agree) and consists of 16 items.

A. ATTITUDE STATEMENTS

No	Expression	1	2	3	4	5
1	The subject of the literature and cultural codes of the Turkic peoples is important to me.					
2	This topic provides rich information that helps me understand the Turkic world.					
3	This subject allows me to learn about the cultures of different Turkic tribes.					
4	The course content is helping me to better understand my own cultural identity.					
5	In my opinion, teaching the literature and cultural codes of Turkic peoples is unnecessary. (-)					
6	This course consists only of theoretical information and has no practical value. (-)					
7	Attending this class makes me happy.					
8	I enjoy following topics related to the literature and cultural codes of Turkic peoples.					
9	I eagerly await the hours when this lesson is taught.					

10	This topic arouses my curiosity.					
11	I get bored while studying this subject and want to give up immediately. (-)					
12	I enjoy discussing class-related topics with my friends.					
13	Outside of class, I also conduct research on the literature and culture of Turkic peoples.					
14	I follow resources (books, articles, documentaries, etc.) related to this topic.					
15	This subject led me to start reading literary works from different Turkic tribes.					
16	I would like to participate in the project work assigned for this topic.					

SCALE SCORING AND EVALUATION	
Positive aspects: • Strongly Disagree: 1 point • I disagree: 2 points • Undecided: 3 points • I agree: 4 points • Absolutely agree: 5 points	**Negative aspects:** • I strongly disagree: 5 points • I disagree: 4 points • Undecided: 3 points • I agree: 2 points • Absolutely Agree: 1 point

Linguistic and Literary Connections Among Turkic Peoples: Achievement Test Questions Based on Ethnocultural Codes

This achievement test was designed to measure the academic success of second-year students at the Faculty of Literature of a university in Kazakhstan on the subject of "Studies on linguistic and literary connections among Turkic peoples based on ethnocultural codes." The test is presented in both classic (open-ended) and multiple-choice question formats. Both formats are designed to measure the same learning outcomes.

SECTION A: CLASSIC (OPEN-ENDED) QUESTIONS

Instructions: Answer the following questions by providing detailed explanations and examples in the spaces provided. Each question has a point value.

1." ethnocultural code." Explain, with examples, which ethnocultural codes are prominent in the literary works (epics, fairy tales, proverbs) of Turkic peoples.

2. The ethnocultural meaning of the concept of "seven ancestors" (jeti ata) in Kazakh culture. Compare this concept with similar codes found among other Turkic groups (e.g., the Kyrgyz and Turkish people).

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3. Explain how the concept of "hospitality" (misafirperverlik) is reflected in proverbs and idioms in the Turkic world, giving at least three examples from different Turkic dialects. Identify the common ethnocultural codes in these proverbs.
4. The ethnocultural meanings of the phrases " Kazılık Mountain" in the Dede Korkut Stories and "Beycin Mountain" in the Manas Epic. What are the functions of the "mountain" cult in Turkish mythology?
5. Write down the meanings of the proverbs from the Turkish dialects given below and identify the ethnocultural codes used in these proverbs:
a) Kazakh: "Bala öge şığar with suggestion, bala jerge without suggestion (b) Kyrgyz: " Akılduu başı baylayt , akılsız başı moyun c) Turkish (Turkey): "Two heads are better than one"

MULTIPLE CHOICE QUESTIONS

Instructions: Read the following questions carefully and mark the correct option. Each question is worth 10 points.
Which of the following best describes the concept of " ethnocultural code"?
A) Technological tools used in a society's daily life, B) Symbolic expressions passed down from generation to generation in a society's cultural memory, C) The political organization of a society, D) Rules regulating a society's economic activities, or E) The written legal rules of a society.
2. is NOT one of the ethnocultural functions of the "jeti ata" (seven ancestors) concept in Kazakh culture?
A) The necessity of knowing one's lineage for seven generations
B) Preserving kinship ties C) Preventing marriages between close relatives D) Emphasizing the sanctity of the seven heavens E) Strengthening social solidarity
3. Ethnocultural meaning of the expressions " Kazılık Mountain" in the Dede Korkut Stories and "Beycin Mountain" in the Manas Epic?
A) Source of economic wealth
B) Political boundary marker C) Sacred place and symbol of heroism
D) Intersection point of trade routes E) Wetland area of agricultural lands
4. In Turkish mythology, the motif of "born from light" does NOT carry which of the following meanings?
A) Divine lineage
B) Divine choice
C) Ordinary human birth D) Extraordinary power E) Celestial origin
5. Kazakh proverb "Konak kelgen "member abundance. Which of the following ethnocultural codes is common to both the Turkish proverb "A guest comes with ten pieces of good fortune, eats one and leaves nine" and the Turkish proverb "A guest comes with ten pieces of good fortune, eats one and leaves nine"?
A) Guests cause trouble
B) Guests bring blessings C) Guests gossip D) Guests mess up the house E) Guests consume food
6. is NOT a common heroic motif found in Turkish epics?
A) Extraordinary birth
B) The sacredness of the horse C) The hero receiving a name D) Establishing a city-state E) Fighting the enemy
7. Which of the following statements about the concept of "Albastı" (Albarstı, Albız) is incorrect?
A) It is known as a spirit that haunts women in childbirth.
B) It is defined with completely identical characteristics in all Turkic tribes. C) Methods such

as red ribbons, prayers, and iron are used for protection. D) It is connected to pre-Islamic Turkic beliefs. E) It serves as a warning function to protect babies.

8. Which of the following pairings regarding color symbolism in Turkish culture is incorrect?
A) White - goodness, purity, holiness
B) Black - evil, mourning, power C) Red - blood, war, coming of age D) Sky - heavens, God, holiness E) Green - mourning, death, separation

9. Which of the following is NOT one of the meanings of the "tree of life" concept in Turkish mythology?
A) Establishing a connection between heaven and earth
B) Symbolizing the continuity of the lineage C) Being a source of immortality D) Providing commercial wealth E) Being a sacred place

10. Which of the following statements about the code for "reason" in Turkish proverbs is true?
A) Wisdom is only found in the elderly.
B) Wisdom is a hereditary trait. C) The tradition of seeking advice (consultation) is important in Turkish culture.
D) Wisdom is less valuable than wealth.
E) Wisdom is a trait exclusive to men.