AI-enabled Learning Platforms for Developing Students' Multicultural Competence in Language Education

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***Abstract*—This study examined whether Artificial Intelligence (AI)-supported language learning platforms were associated with higher gains in secondary school students' multicultural competence in Ukrainian language education. The study used a quasi-experimental classroom design with 98 seventh-grade students from three Ukrainian schools: a control group (n = 49) followed traditional language learning, whereas an experimental group (n = 49) used Mango Classroom, TalkPal, and SpeakAi during a 10-week intervention under a unified instructional sequence. Multicultural competence was treated as the primary educational construct, while cultural intelligence was used as the measurable operational framework through an adapted Ukrainian version of the Cultural Intelligence Scale. The adapted instrument was reviewed by language education specialists, piloted with adolescent learners, and demonstrated acceptable internal consistency for the study sample. The experimental group showed higher pre-post gains than the control group across the metacognitive, cognitive, motivational, and behavioural components. The strongest change was observed in the motivational component, which increased from 3.3 to 4.1 points, while the corresponding growth in the control group was smaller. The frequency of platform use was positively associated with changes in all components, with the strongest correlation for motivation (r = 0.72; p < 0.01). Qualitative reflections indicated that students most often reported comparison of everyday sociocultural practices (46%), reduced anxiety in intercultural dialogue (39%), and reconsideration of stereotypes (34%). The academic contribution of the study is the development and pilot testing of a school-based model for integrating AI-enabled language platforms into the development of students' multicultural competence in Ukrainian secondary education. The findings provide context-bound evidence that AI-supported platforms can support multicultural competence development when embedded in structured classroom tasks, guided reflection, and culturally marked language scenarios. The results should be interpreted with caution because the groups were not randomly assigned and the intervention was limited to one age group and one national context.**

***Keywords*—artificial intelligence, multicultural competence, cultural intelligence, intercultural communication, adaptive learning**

I. Introduction

Language education in the twenty-first century is increasingly connected not only with learning grammar and vocabulary, but also on the development of multicultural competence as a condition for communication in culturally diverse settings. Artificial Intelligence (AI)-supported platforms may create additional opportunities for language simulations, adaptive feedback, dialogue practice, and exposure to culturally marked content [1]. However, these opportunities are not uniform across all systems: platform functionality, language localization, data quality, teacher mediation, and access to devices influence whether AI tools support or limit intercultural learning [2]. Concerns about biased content, hallucinated responses, overdependence on automated feedback, privacy, and unequal access are especially relevant in school contexts where learners are minors and require guided pedagogical support [3].

In this context, AI-enabled platforms were considered not as self-sufficient replacements for language teaching, but as mediated learning environments that can support culturally situated dialogue, pronunciation practice, scenario-based communication, and reflective comparison of social practices when used under teacher guidance [4]. Mango Classroom, TalkPal, and SpeakAi were selected because they combine structured language tasks, adaptive prompts, speech-based interaction, and feedback mechanisms that can be aligned with intercultural learning objectives [5]. At the same time, the study avoided treating all AI tools as equally capable: the platforms were analysed through their observable classroom functions and through students' measured changes during a controlled instructional sequence [6].

The aim of this study is to evaluate the effect of three AI-enabled language learning platforms Mango Classroom, TalkPal, and SpeakAi on the development of secondary school students' multicultural competence [7]. This focus is important because much of the existing literature addresses higher education, adult learners, general language automation, or technological acceptance, whereas less evidence is available on how specific AI-supported platforms operate in middle-school language lessons under comparable instructional conditions [8].

Multicultural competence was used as the primary educational construct in the study. It refers to students' ability to interpret cultural meanings, compare communicative norms, regulate interaction in culturally diverse situations, and reflect on their own cultural assumptions [9]. Cultural

intelligence was used as an operational measurement framework because the Cultural Intelligence Scale provides measurable metacognitive, cognitive, motivational, and behavioural dimensions [10]. This mapping does not imply that cultural intelligence fully exhausts multicultural competence; rather, it provides a measurable subset suitable for evaluating changes in culturally diverse communicative situations in the school language classroom.

II. Literature Review

The literature on AI-supported language education can be grouped into several strands. The first strand examines AI as a means of improving language proficiency and interactional practice. Long and Lin [11] and Zhang *et al.* [12] reported that AI-oriented English teaching can support communicative and intercultural outcomes, while Salas-Pilco *et al.* [13] and Davoodi [14] emphasized accessibility and inclusion for linguistically diverse learners. These studies indicate that AI may support intercultural language learning, but they also show that outcomes depend on the educational level, learner group, and pedagogical integration rather than on technology alone.

A second strand focuses on adaptive and cloud-based language systems. Xia *et al.* [15], Huiying and Qiang [16], and Wei [17] linked AI tools with adaptive strategies, cross-cultural teaching, and critical thinking in English learning. Their findings are relevant to the present study because they treat intercultural learning as more than linguistic accuracy; however, most of these works remain focused on either higher education or general AI-mediated language development. A third strand addresses learner diversity, motivation, and inclusive learning design in multicultural or multilingual environments [18–27]. These publications support the assumption that AI can structure culturally marked interaction, but they also demonstrate the need to distinguish language automation from the broader development of multicultural competence.

A fourth strand concerns dialogic systems, teacher readiness, and ethical or methodological risks. Studies on intelligent dialogue systems, pedagogical AI competencies, and online teaching methods show that simulated interaction can support engagement, but only when teachers are prepared to manage platform limitations, content bias, and learner dependence on automated feedback [28–35]. Therefore, the literature suggests a clear evidence gap: there is still insufficient school-based empirical evidence on how specific AI-supported language learning platforms influence multicultural competence among younger learners under comparable classroom conditions.

The application of Deep Learning (DL) in intercultural education is revealed in the work of Sun [28], who proposed an intelligent system for teaching English. Zhai *et al.* [29] analysed the intercultural, humorous, and empathetic aspects of dialogic AI systems. The publication by Zou *et al.* [30] is of special interest, where a competency framework is proposed for training teachers to work with pedagogical AI. Kianinezhad [31] also emphasized the importance of online foreign language teaching methods that integrate AI capabilities to increase teaching efficiency. Recent studies confirm the growing role of AI in supporting students' communicative skills through personalized language interaction. Gomathi *et al.* [32] demonstrated the effectiveness of using AI-based adaptive language systems to form English language competence. The study by Drushchak, Tyshchenko, and Polyakovska [33] focuses on building responsible recommender systems for primary and secondary school students that combine behavioural analytics and ethical content filtering. Lee *et al.* [34] consider a semantic co-learning model in which students interact with a Sentence-Bidirectional Encoder Representations from Transformers (SBERT) transformer agent as part of collaborative learning. Finally, Ayodele and Zhou [35] revealed the DL potential to build educational platforms focused on co-creation of knowledge and sharing of culturally meaningful experiences in Higher Education Institutions (HEIs).

Overall, previous research confirms the pedagogical potential of AI-supported language learning, but it also reveals several unresolved issues: the difference between language proficiency and multicultural competence, the limited number of school-level studies, insufficient reporting of platform-specific learning mechanisms, and the need for clearer measurement alignment. The present study addresses this narrower gap by analysing the use of Mango Classroom, TalkPal, and SpeakAi in a unified classroom sequence with Ukrainian seventh-grade students.

The study draws on foundational approaches to multicultural competence, particularly the work of Byram and Deardorff, while using cultural intelligence as an operational framework for measuring students' capabilities in culturally diverse communicative situations through the Cultural Intelligence Scale (CQS) [36, 37]. In this study, multicultural competence is used as the primary educational construct, while cultural intelligence refers to the measurable set of capabilities assessed through the Cultural Intelligence Scale.

III. Problem Statement

Digital platforms with AI elements are changing approaches to language education, but their use in school-based multicultural competence development remains uneven. Traditional foreign language teaching often includes cultural topics, yet these topics may remain episodic and weakly connected with students' communicative practice. At the same time, AI-supported dialogue, feedback, and simulation tools can help students rehearse culturally marked situations, provided that these tools are integrated into a coherent instructional model rather than used as isolated digital activities.

A key problem is that platform capabilities are often described too generally. Some tools can generate dialogue prompts, provide pronunciation support, or adapt tasks, but these functions do not automatically ensure multicultural learning. For school students, the pedagogical effect depends on age-appropriate tasks, teacher guidance, access to technology, cultural localization, and the validity of the measurement instrument used to assess the outcomes.

The research gap is the lack of school-based quasi-experimental studies that evaluate specific AI-supported language learning platforms in relation to multicultural competence development under comparable instructional conditions. The study therefore focused on

seventh-grade Ukrainian learners, a 10-week classroom intervention, and a measurement design that connected multicultural competence with observable components of cultural intelligence. Earlier studies generally confirm the pedagogical value of AI for adaptive language learning; however, they differ in sample, educational level, and outcome variables. Most of them focus on linguistic or motivational gains, whereas fewer studies investigate multicultural or multicultural competence as a multidimensional educational outcome, especially in school settings.

The study was designed to clarify whether regular interaction with Mango Classroom, TalkPal, and SpeakAi was associated with higher gains in multicultural competence than traditional language learning, while also identifying platform-related task formats, reflective patterns, and limitations of interpretation. The research gap is the lack of school-based empirical studies that evaluate specific AI-enabled language learning platforms in relation to multicultural competence development under comparable instructional conditions.

IV. Proposed Methodology

A. Research Stages

The study used a quasi-experimental classroom design based on existing school groups. A total of 98 seventh-grade students from three Ukrainian schools were assigned to the control group (CG; $n = 49$) or the experimental group (EG; $n = 49$) according to the instructional organization of the participating schools; random assignment of individual students was not applied. The CG followed traditional language learning activities, while the EG worked with Mango Classroom, TalkPal, and SpeakAi as one combined AI-supported intervention. All EG students used the three platforms within a unified instructional sequence; platform-specific comparisons were therefore interpreted as exploratory task-level comparisons rather than as three independent treatment arms. Within the experimental condition, platform use was organized according to a unified instructional sequence, with students completing comparable language tasks through Mango Classroom, TalkPal, and SpeakAi under the same instructional schedule and teacher guidance.

Comparability across the experimental platforms was supported through matched lesson duration, target language level, intercultural themes, task typology, teacher guidance, and assessment timing. The same thematic units were used in the CG and EG, but the CG completed textbook-based dialogues, teacher-led discussion, vocabulary practice, and written reflection without AI-supported prompts or automated feedback. Within each school, teachers followed a common lesson plan in order to reduce teacher-mediated variation between conditions. Given the moderate sample size, the findings should be interpreted as context-bound empirical evidence rather than as a basis for unrestricted generalization. The study employed a quasi-experimental design based on existing school groups, and this procedure is now described explicitly in order to clarify the limits of randomization and the potential risk of selection bias.

Comparability across platforms was ensured through unified instructional conditions, including matched lesson duration, target language level, intercultural themes, task typology, teacher guidance, and assessment timing.

B. Sample

The sample consisted of 98 seventh-grade students from secondary schools in Lutsk, Chernihiv, and Vinnytsia. All participants had a pre-verified English proficiency level of A2–B1 and stable access to digital devices during the intervention. Baseline equivalence between the CG and EG was checked using demographic indicators, prior English achievement, and pre-intervention Cultural Intelligence Scale scores. Socioeconomic indicators were not collected in order to avoid gathering additional sensitive data from minors.

The key to this design is that students provided a controlled environment within which the functional effectiveness of digital platforms was tested. Each EG worked on the same schedule (2–3 45-minute classes per week), performed tasks of equivalent complexity and typology (language simulations, chatbots, role-playing scenarios), and also received unified culturally labelled content integrated into the platforms. The CG ($n = 49$) used classical teaching methods without the involvement of AI technologies for the purpose of clearly distinguishing the contribution of the platforms as an independent variable. Therefore, the study focuses on the level of multicultural competence development provided by each of the platforms under equal operation in a unified learning environment. The study employed a quasi-experimental design based on existing school groups, with students assigned to the control and experimental conditions according to the instructional organization of the participating schools.

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Baseline equivalence between the control group and the experimental group was assessed using pre-intervention CQS scores and key demographic indicators; the results are presented in Table 1.

Table 1. Baseline characteristics of the control and experimental groups before the intervention (CQS = Cultural Intelligence Scale)

Characteristic	Control group ($n = 49$)	Experimental group ($n = 49$)	Baseline comparison
Age, years, M ± SD	12.8 ± 0.4	12.9 ± 0.4	$t = 0.82$, $p = 0.414$
Female students	25 (51.0%)	24 (49.0%)	$\chi^2 = 0.04$, $p = 0.839$
Prior English grade, M ± SD	8.2 ± 1.0	8.3 ± 1.1	$t = 0.47$, $p = 0.639$
Overall CQS pretest, M ± SD	3.31 ± 0.46	3.35 ± 0.48	$t = 0.42$, $p = 0.676$
English proficiency level	A2–B1	A2–B1	Descriptive equivalence
Access to digital platforms	Yes	Yes	Descriptive equivalence
Instructional format	Traditional language learning	AI-supported language learning	Design feature

The study involved minor participants and was conducted in accordance with ethical requirements for educational research. Participation was voluntary, parental informed consent was obtained prior to data collection, and all student responses were anonymized before analysis.

C. Instruments

AI platforms: The main research tool was three digital platforms with built-in AI modules—TalkPal, Mango Classroom, and SpeakAi—which were selected as objects of comparative analysis. Each of them uses different types of language engineering, adaptive learning, and contextual feedback to assess the effectiveness of their functioning in a unified environment. All platforms were pre-tested for stability, support for the Ukrainian language, and the presence of scenarios relevant to culturally marked content. Table 2 presents the generalized technical characteristics of the AI platforms used in the study.

Additionally, each platform was tested in an interactive mode with recording of interface behaviour, in particular response generation time, correspondence of replicas to the sociocultural context and accuracy of speech recognition. Screencasts of interface reactions in simulated scenarios were performed to support functional observations. The generalized model of AI integration into language learning is presented as a cycle (Fig. 1), which includes five key stages: from receiving a task through the Learning Management System (LMS) to saving the results after interaction with adaptive AI modules.

Table 2. Pedagogically relevant features of the Artificial Intelligence (AI)-supported platforms used in the study

Platform name	Main interaction mode	Language support	AI-supported features observable by users	Pedagogical relevance for the study
TalkPal	Interactive dialogue practice	English and other major foreign languages	AI-generated conversational prompts, pronunciation support, contextual response suggestions	Supports intercultural dialogue practice and adaptive spoken interaction
Mango Classroom	Structured language learning activities	English with culturally themed learning content	Adaptive exercises, automated feedback, scenario-based tasks, vocabulary and pronunciation support	Supports guided multicultural language learning through structured practice
SpeakAi	Role-play and speech-based interaction	English and selected foreign language scenarios	Speech recognition, real-time response support, role-based communication tasks	Supports situational communication and culturally contextualized speaking practice

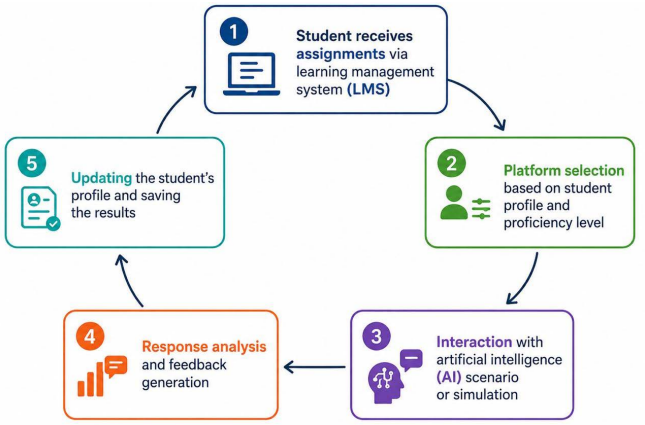


Fig. 1. Cycle of integrating artificial intelligence into the language learning process.

CQS survey: before and after the intervention, students completed an adapted Ukrainian version of the Cultural Intelligence Scale (CQS), which measured four components: metacognitive, cognitive, motivational, and behavioural. The instrument was translated and back-translated by two bilingual language education specialists, reviewed by three experts in intercultural education, and piloted with 18 seventh-grade students who were not included in the main sample. Minor wording changes were introduced to improve age appropriateness while retaining the original component structure. In the main sample, internal consistency was acceptable (Cronbach's α = 0.78 for the metacognitive component, 0.76 for cognitive, 0.82 for motivational, 0.74 for behavioural, and 0.86 for the overall scale).

Observation: weekly classroom observation recorded students' task completion, number of interactions with the platforms, level of participation in simulated situations, and quality of responses. Fidelity checks were conducted through teacher logs and weekly summaries of completed tasks, which confirmed that the EG followed the same platform rotation schedule and comparable task duration across the three schools.

Statistical Package for the Social Sciences (SPSS), version 26: statistical processing included descriptive statistics, paired-samples comparisons, difference-in-differences estimates, Pearson correlations, one-way Analysis of Variance (ANOVA) for exploratory platform-related outcomes, effect sizes, and 95% confidence intervals where applicable. Because students were nested within schools/classes, sensitivity checks with school-fixed effects were also conducted to examine whether the direction of the main findings remained stable after accounting for school-level clustering.

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Observation: weekly recording of students' activity, number of language interactions, level of involvement in simulated situations, and quality of completed tasks.

SPSS (v.26): statistical processing of results, including

plotting, calculation of mean values, standard deviations, t-coefficients, and analysis of variance.

The data analysis involved descriptive statistics, pre-test and post-test comparisons of Cultural Intelligence Scale (CQS) scores, correlation analysis between the frequency of platform use and changes in CQS scores, and comparative analysis of platform-related outcomes where applicable. Mean values and standard deviations were calculated for the main variables, while statistical tests were used to identify differences in the dynamics of multicultural competence between the study conditions. For each student, change scores for the overall CQS and its four components were calculated using Eq. (1):

$$\Delta CQS_i = CQS_{\text{post},i} - CQS_{\text{pre},i}, \quad (1)$$

where ΔCQS_i is the change in the CQS score for student i, $CQS_{\text{post},i}$ is the post-intervention score, and $CQS_{\text{pre},i}$ is the pre-intervention score. Positive values indicate an increase in the score, negative values indicate a decrease, and a value of zero indicates no change.

Case analysis: analysis of open-ended responses to questions about personal experience of intercultural interaction in a digital environment and assessment of the effectiveness of educational tools.

During the 10-week intervention, students in the experimental condition completed culturally themed language tasks, including dialogue simulations, service encounters, travel scenarios, and short reflective exchanges supported by AI-generated prompts, pronunciation feedback, and context-sensitive response suggestions. Open-ended student responses were analysed through structured thematic categorization focused on recurrent meanings related to cultural comparison, communicative comfort, stereotype reflection, motivational engagement, and self-awareness in intercultural interaction.

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This methodology made it possible to assess in a structured way the impact of AI platforms on the development of students' multicultural competence, taking into account cognitive, motivational, and behavioural changes, as well as to determine the effectiveness of specific types of educational tasks and the frequency of their implementation in language education.

V. Results and Discussion

A. Dynamics of Changes in Multicultural Competence in the CG and EG

Quantitative analysis of the CQS questionnaire results before and after the 10-week intervention showed higher gains in the EG than in the CG. Because the design was quasi-experimental and based on existing classes, the results were interpreted as evidence of association rather than as proof of causal effectiveness. The strongest change was recorded in the motivational component, while metacognitive, cognitive, and behavioural components also imreported.

The pre-/post-test differences presented in Table 3 were calculated using paired-samples t-tests.

Table 4 shows that all four CQS components demonstrated statistically significant pre-/post-test improvement. In addition to *p*-values, effect sizes were included to clarify the magnitude of the observed changes. The largest effect was identified for the motivational component, while the metacognitive, cognitive, and behavioural dimensions also demonstrated substantial positive change. To examine whether the observed differences among Mango Classroom, TalkPal, and SpeakAi were statistically significant, a one-way ANOVA was conducted for the main platform-related outcomes. The analysis revealed a statistically significant effect of platform type on execution quality, $F(2, 144) = 5.21$, $p = 0.006$. Post hoc comparisons indicated that Mango Classroom demonstrated significantly higher values than TalkPal, whereas the difference between Mango Classroom and SpeakAi was less pronounced. These results indicate that the instructional contribution of the platforms differed depending on the type of AI-enabled activity.

Table 3. Comparison of mean values by components of the Cultural Intelligence Scale before and after the experiment

CQS Component	Mean (before)	Mean (after)	Standard deviation (before)	Standard deviation (after)	t-value	*p*-value	Effect size (Cohen's d)
Metacognitive	3.4	4.0	0.51	0.42	6.32	<0.001	1.28
Cognitive	3.2	3.8	0.47	0.45	5.89	<0.001	1.30
Motivational	3.3	4.1	0.49	0.39	7.04	<0.001	1.81
Behavioural	3.5	4.0	0.52	0.44	5.11	<0.001	1.04

Table 4. Programme for the application of artificial intelligence platforms in developing multicultural competence

Learning Category	Task type	Frequency of use	Methods of evaluating results
Lexico-Cultural Sensitivity	Language simulations with adaptive difficulty	2 times a week for 45 min	Automated testing, Cultural Intelligence Scale (CQS) survey
Communicative Interaction	Chatbots with cross-cultural scenarios	1 time a week for 30 min	Observation, quantitative analysis of interactions
Comparison of Cultural Practices	Visual cards, short videos, interactive quests	1 time a week for 40 min	Response analysis, self-assessment
Role Playing	Dialogues in different socio-cultural contexts (shop, travel, doctor's visit)	1 time every 2 weeks	Video recording, analysis of speech acts

B. Distribution of Changes by Components of Multicultural Competence

Comparative visualization of the CQS questionnaire results clearly presents the dynamics of changes in multicultural competence in the CG and EG. Fig. 2 shows the average values for each of the four components before and after the experiment. A slight increase in indicators was observed in the CG, which can be explained by the natural learning process. At the same time, a significant increase was found in all components of the scale in the EG, which worked with the TalkPal, Mango Classroom and SpeakAi platforms. The greatest dynamics were recorded in the motivational and metacognitive components. This indicates an increase in students' interest in intercultural interaction and an improvement in their ability to understand cultural contexts in the course of communication. The visualized data in Fig. 3 confirms the effectiveness of using platforms with AI elements for the development of multicultural competence in language education.

Fig. 2 shows that the EG students who worked with the Mango Classroom, TalkPal, and SpeakAi platforms demonstrated significantly higher growth dynamics in all four components of the CQS compared to the CG. In particular, the metacognitive component increased by an average of 1.01 points, while it increased by only 0.33 in the CG. Similar gaps are observed in the cognitive (+0.93 vs. +0.32), motivational (+0.86 vs. +0.32), and behavioural (+0.81 vs. +0.28) components. This indicates a positive impact of AI platforms on the development of multicultural competence, which is implemented through adaptive task complexity, intercultural interaction scenarios, and personalized feedback. Therefore, the use of AI-based tools ensured a deeper assimilation of the cultural context and increased interpersonal sensitivity in language education.

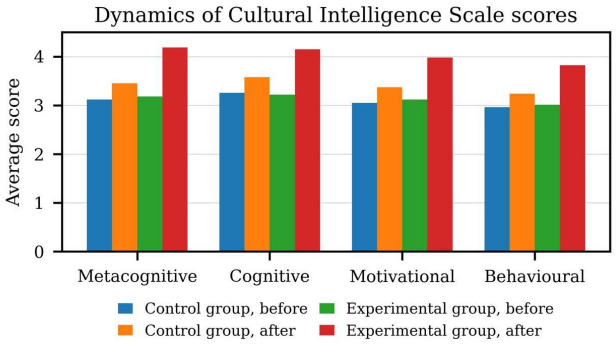


Fig. 2. Dynamics of Cultural Intelligence Scale scores in the control and experimental groups (points) SPSS.

C. Correlation between Frequency of Use of AI Platforms and CQS Level

Analysis of the EG results using the Pearson correlation coefficient revealed a significant statistical relationship between the frequency of use of AI platforms (TalkPal, Mango Classroom, SpeakAi) and the level of multicultural competence according to the CQS. Fig. 3 shows the correlation between the frequency of students' interaction with AI platforms and the level of multicultural competence according to the CQS components.

Fig. 3 shows the highest correlation recorded for the motivational component ($r = 0.72$; $p < 0.01$), which indicates a high dependence of students' motivational engagement on regular interaction with adaptive language scenarios. The metacognitive component also showed a significant positive correlation ($r = 0.68$; $p < 0.01$), indicating the stimulation of reflective processes under the influence of simulation learning. The cognitive component revealed a slightly lower, but still statistically significant level of correlation ($r = 0.61$; $p < 0.05$), which confirms the impact of interactive content on enriching knowledge about cultural systems.

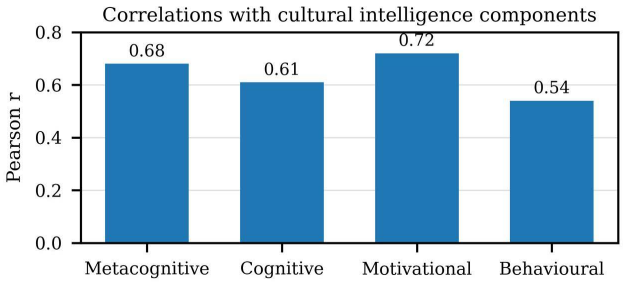


Fig. 3. Relationship between platform-use frequency and multicultural competence indicators.

The lowest relationship was found in the behavioural component ($r = 0.54$; $p < 0.05$), which may be determined by the limitations of the real cultural environment and the time range of the experiment. Overall, the obtained results indicate that the frequency of use of AI platforms is positively correlated with all components of multicultural competence, especially in the aspects of motivation and self-reflection, which once again confirms the effectiveness of using adaptive learning technologies in language education.

D. Qualitative Analysis of Students' Intercultural Reflection

Qualitative analysis of open-ended responses of the EG students identified a number of typical reflective patterns, which indicated the development of key components of multicultural competence. The responses were collected after the completion of a 10-week cycle of work with the Mango Classroom, TalkPal and SpeakAi platforms. The students expressed their own impressions of the experience of intercultural interaction in a digital environment, which enabled not only to supplement the quantitative results, but also to understand more deeply the internal mechanisms of the development of intercultural sensitivity, self-awareness and motivation for dialogue. Fig. 4 presented the summarized results of the students' reflection patterns.

As Fig. 4 shows, the highest proportion of responses (46%) was made up of mentions of comparing everyday socio-cultural practices, which confirms the students' ability to identify differences between communicative norms of different cultures as a result of working with adaptive AI scenarios. The second most common issue was reducing communicative anxiety (39%), which indicates the positive impact of the Mango Classroom, TalkPal and SpeakAi platforms on students' emotional comfort during intercultural language learning. A significant proportion of responses (34%) were considerations related to rethinking stereotypes, which indicates the development of cognitive flexibility and cultural awareness. Enhancing motivational interest in the traditions of other peoples (28%) and forming a clear idea of their own cultural identity (22%) are additional evidence of

the effectiveness of using AI platforms in developing multicultural competence of secondary school students.

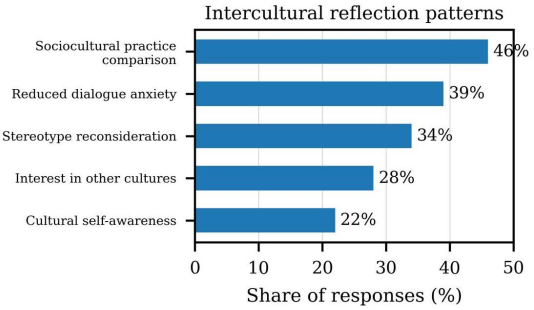


Fig. 4. Typical patterns of students' intercultural reflections during platform-supported language learning.

E. Evaluating the Effectiveness of Types of Learning Tasks

Evaluation the effectiveness of different types of educational activities implemented using the Mango Classroom, TalkPal, and SpeakAi platforms identified the specifics of their impact on the development of students' multicultural competence. The collected data covered three key parameters: the frequency of use of tasks, the level of student engagement in the implementation, and the quality of the results. Both the results of systematic observation and student self-assessment were used for the objectivity of the assessment.

The analysis revealed that different types of tasks have different effects on the multicultural development components. Those formats that involve emotionally coloured interaction, role-playing, or adaptive modelling of intercultural communication situations are the most significant. Because individual responses could contain more than one reflective theme, the coding categories were treated as overlapping; therefore, the reported percentages do not sum to 100%. Table 5 presents the summarized results.

The data in Table 5 indicate that language simulations based on the Mango Classroom platform were the most effective in all parameters: the average frequency of their use was 2 times a week, the engagement rate was 4.6 points on a five-point scale, and the quality of task performance was 88%. Chatbots with cultural feedback implemented in TalkPal had a lower frequency (1 time per week), as well as slightly lower engagement (4.2) and effectiveness (81%). Role-playing games used through SpeakAi were conducted the least often (once every two weeks), but demonstrated consistently high rates of student engagement (4.4 points) and quality of task performance (85%). These results confirm that the frequency of interaction is not the only criterion for effectiveness: the role-playing format, although less frequent, provides a deeper immersion in the situation of intercultural communication, and chatbots play the role of a supporting mechanism with a smaller but systemic impact. As Table 5 shows, all three task formats contribute to the development of multicultural competence, but the simulation modules demonstrate the greatest pedagogical effectiveness. Although simulation-based tasks demonstrated the strongest observed outcomes, this result should be interpreted with caution because their frequency of use was higher than that of the other task formats. Execution quality refers to the proportion of task performance meeting predefined instructional criteria, including response relevance, contextual appropriateness, and adequacy of language use within the assigned intercultural scenario. Fig. 5 illustrates the comparative effectiveness of the three AI platforms—Mango Classroom, TalkPal, and SpeakAi—according to three key criteria: engagement rate, quality of interaction, and feedback.

Table 5. Effectiveness of artificial intelligence task types in language learning (according to observation and self-assessment data)

Task type	Platform name	Frequency (times/week)	Average engagement level (0–5)	Execution quality (%)
Language simulations	Mango Classroom	2	4.6	88
Chatbots with cultural feedback	TalkPal	1	4.2	81
Role-playing in interaction situations	SpeakAi	0.5	4.4	85

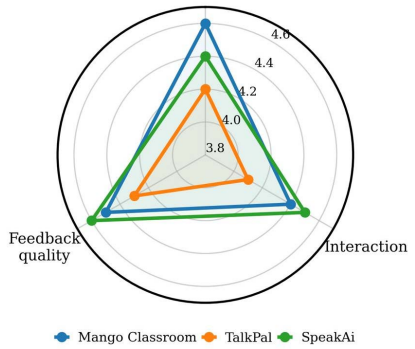


Fig. 5. Comparison of platforms by effectiveness criteria: engagement, interaction, quality of feedback.

The highest agreed indicators are observed in SpeakAi, while Mango Classroom leads in engagement, and TalkPal demonstrates moderate stability in all three directions.

Summarizing the experiment results, we can conclude that the use of platforms with AI elements (Mango Classroom, TalkPal, SpeakAi) contributed to a significant increase in the students' multicultural competence. Quantitative analysis using the CQS confirmed statistically significant dynamics in all components, especially in the motivational and metacognitive components. The obtained results confirm the appropriateness and effectiveness of introducing AI platforms into language education for the formation of students' multicultural sensitivity.

The obtained results indicated that the AI-supported platform sequence was associated with higher gains in multicultural competence than traditional language learning in the studied school context. This finding was consistent with earlier evidence that adaptive learning environments and simulation-based interaction can support intercultural sensitivity [18–20]. The comparison with previous studies clarified the mechanism of the effect: in the present intervention, improvement was not limited to language practice, but was connected with repeated culturally situated tasks, guided reflection, and feedback on communicative choices [21].

The qualitative results also showed that students' reflections concentrated on comparing everyday

sociocultural practices, reducing communicative anxiety, and reconsidering stereotypes [22]. This pattern corresponded to studies that emphasized the role of simulated dialogues and multimodal AI interaction in lowering social barriers and supporting intercultural communication [23, 24]. The return to the quantitative results explains why the motivational component demonstrated the largest change: regular platform interaction created repeated low-risk opportunities for communication, although the novelty effect and increased teacher attention could also have contributed to the observed gains [25]. The findings support the pedagogical potential of AI-enabled language platforms in the studied school context; however, they should not be interpreted as universally transferable without further validation in broader educational settings [26, 27].

Several alternative explanations remained plausible. The observed differences may have been influenced by the novelty of working with AI-supported platforms, greater attention given to the EG, social desirability in self-report responses, and unequal prior familiarity with digital tools. The quasi-experimental design reduced but did not eliminate selection bias and clustering effects, even though baseline comparisons and school-fixed sensitivity checks were added. Therefore, the findings should be interpreted as short-term, context-bound evidence rather than as confirmation of stable long-term effects. Additional limitations include possible teacher-mediated effects, differences in students' prior digital familiarity, the novelty effect associated with AI-based interaction, the moderate sample size, and the context-bound character of the intervention.

Despite these limitations, the results have applied value for school language education. They suggest that AI-supported platforms may be useful when platform tasks are embedded into teacher-guided scenarios, when multicultural competence is operationalized through clear dimensions, and when automated feedback is combined with classroom reflection. The practical implication is not that AI platforms independently develop multicultural competence, but that they can mediate culturally meaningful language interaction when teachers control task design, ethical use, and interpretive follow-up. The observed gains may be interpreted not merely as a technological effect, but as the outcome of repeated engagement with culturally situated language interaction, adaptive support, and reflective prompts, which together align with process-oriented models of multicultural competence development. The practical implementation of AI-enabled multicultural learning depends not only on platform functionality, but also on teacher preparedness, methodological support, and localization of content to the educational context.

VI. Conclusions

The results of the pedagogical experiment provided context-bound evidence that Mango Classroom, TalkPal, and SpeakAi were associated with higher development of multicultural competence among seventh-grade students during the 10-week intervention. Quantitative analysis using the CQS showed positive changes in all four components, with the strongest increase in motivation and metacognitive awareness. Correlation analysis indicated positive relationships between frequency of platform use and CQS dynamics, especially for the motivational component ($r = 0.72$; $p < 0.01$). Qualitative responses showed that students most often mentioned comparison of everyday sociocultural practices, reduced anxiety in intercultural dialogue, and reconsideration of stereotypes. These results should be understood as preliminary evidence requiring replication with larger samples, longer interventions, and stronger control for teacher and school effects.

The study contributes to the discussion on AI-supported language education by showing how adaptive digital platforms may function as mediated environments for multicultural competence development when intercultural content, guided reflection, and classroom integration are combined. Future studies should include larger and more diverse samples, long-term follow-up, validated adolescent-specific measurement tools, and clearer separation between combined platform interventions and platform-specific effects. The reported findings reflect short-term educational changes observed during a 10-week intervention and should therefore be interpreted as preliminary evidence rather than as confirmation of stable long-term effects.

The study contributes to the discussion on AI-enabled language education by showing how adaptive digital platforms may function as mediating environments for multicultural competence development when intercultural content, guided reflection, and classroom integration are combined in a coherent instructional model. Future studies should include larger and more culturally diverse samples in order to examine the transferability and stability of the observed effects across educational settings. Further research may investigate the long-term effects of AI-enabled multicultural learning and explore the scalability of this instructional approach in upper secondary, higher education, and professional training environments.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Marianna Ostrovska supervised the paper and provided funding and sources. Kateryna Margitych and Dara Kovrei conducted the research, and provided the methodology. Liudmyla Maretska and Oksana Lytvynko provided the conceptual analysis and sources. All authors wrote and edited a final draft together.

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