

Article

Using AI Approach to Explore Vietnamese ESL Students' Perceptions on Integrations of Local Culture into English Language Teaching

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Abstract

This study aims to explore perceptions of English as a Second Language (ESL) students on integrations of local culture into English language teaching using Artificial Intelligence approaches. Research samples included 511 ESL students of the English Faculty of four public universities in Vietnam's Mekong Delta region. The input factor dimensions comprise demographics, level of local culture integration, facilities, and curriculum-related factors. The output factor was necessities for local culture–English-teaching integration. Two supervised machine learning algorithms, Decision Tree (DT) and Support Vector Machine (SVM), were applied with oversampling to address data imbalance issues. Results indicated that the oversampling case achieved the highest performance. The research shows that the DT model was slightly better than the SVM with an accuracy of 97% and AUC of 98%. Feature importance analysis identified curriculum, facilities, and students' hometown as key predictors. The findings provided empirical evidence to support data-informed curriculum reform in culturally responsive English language teaching. This study also develops a novel method to explore students' perceptions and offers practical suggestions for improving academic quality. This study is expected to enhance institutional student recruitment while contributing to the region's sustainable development and the broader goal of preserving intangible cultural heritage in Vietnam's Mekong Delta.



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1. Introduction

The Mekong Delta region of Vietnam is home to Khmer, Cham, and Hoa (Chinese) communities that have deeply preserved their ancestral traditions while harmoniously integrating into modern society, adding rich and unique cultural layers to the regions' tourism

and economic landscape (Hai, 2026). This region is currently accelerating tourism development and attracting global investment across multiple economic sectors (VCCI, 2021; PwC Vietnam, 2024). Consequently, there is a high demand for high-quality human resources, who possess both foreign language proficiency and knowledge of the distinctive local cultural values. These localized knowledge and skills, coupled with the appreciation of cultural diversity, are essential for driving regional sustainable development and for fulfilling Target 4.7 of the UNESCO's 2030 Agenda (UNESCO, 2019). However, a significant challenge lies in the shortage of such high-quality human resources (Pham, 2022). During the 2010–2020 period, the proportion of university students in Mekong Delta was 8.8% of the national total, whereas this figure in the northern Red River Delta was 40.9% (Ho, 2024). Compared to the Kinh (Vietnamese) communities, Khmer and Hoa (Chinese)—the largest ethnic minority populations communities—continuously face persistent barriers in accessing equitable and culturally sustaining education (Duong et al., 2026; Hai, 2026). Accordingly, in the education sector, in 2023 and 2024, these two communities have received special attention from state and local authorities with 39.3% (over VND 3500 billion) of the provincial budget (Government of Vietnam, 2021a, 2021b). Therefore, society increasingly relies on universities to cultivate the skillful workforce and to promote regional local cultural heritage globally to support regional sustainable development. A majority of university students majoring in English have been expected to enter the workforce in this area after graduation.

Integrating culture, especially local culture, into English language teaching (ELT) has been more favorable due to mutual benefits. For students, this integration can increase student participations, learning motivations, and comprehension by linking English language concepts and/or skills with culturally familiar and relevant contexts (Ahmed et al., 2019; T. H. M. Nguyen & Nguyen, 2022; Ratri et al., 2024; H. N. Le et al., 2026). It also helps students enhance their cultural awareness and appreciate their local cultural roots (Auladi & Bakhtiar, 2024; Tazhitova et al., 2025). Culturally, it builds bridges between local identities and global communication, turning English language learners into experts in cultural encounters through local culture explanation in English. At university levels, since local culture integration in ELT has been illustrated to foster English learning success (Alakrash et al., 2021) and to help students promote their local cultural heritage in global communication, the targets, skills, and materials of culture-integrated ELT should be seriously designed so that students can acquire culture skills in the university and use these skills in the workplace.

Teaching materials are very important in the teaching and learning process, especially in student-centered education. Many universities wish to update the academic curriculum and syllabus for integrations of local culture into ELT (Ratri et al., 2024). In modern curriculum design, adding a new subject or moving a subject in the program should not be based only on teachers' opinions. According to Macalister and Nation (2019), curriculum changes need to be based on needs analysis. This means schools should carefully study students' present needs and future career goals. From the view of the educational supply chain, students can be considered as "customers" whose opinions help improve training quality (Huynh-Cam et al., 2024c). Listening to students' perceptions and understanding what students need can aid universities in designing more practical and sustainable academic programs. Yet, there are still few studies about students' perceptions of integrating local culture into English programs at the university level. Most research focuses on teachers' opinions (Ahmed et al., 2019; Ghavamnia, 2020; Toledo-Sandoval, 2020) or classroom activities (T. N. A. Le, 2023; Huynh-Cam et al., 2024a). There is a limited number of studies focusing on how students evaluate the importance and usefulness of local culture in their learning, which serves as a needs-analysis step—an indispensable step in curriculum design (Macalister & Nation, 2019) in the Vietnam's Mekong Delta region.

Artificial intelligence (AI) approaches using machine learning (ML) algorithms have demonstrated strong performance in diverse fields such as tourism (Chang et al., 2019), first-year students' dropouts (Huynh-Cam et al., 2025), movie projects in crowdfunding (M. Y. Chen et al., 2022), early employment for recent graduates (L. S. Chen et al., 2025), and students' satisfactions with e-learning adoptions (Huynh-Cam et al., 2024b). However, it should be noted that although AI approaches have been widely and successfully applied across interdisciplinary fields, several studies focused on using AI approaches in emerging regions with infrastructural deficits and low levels of digital literacy like Vietnam's Mekong Delta region (T. N. A. Le, 2023). Additionally, limited research explored the perceptions of English as a Second Language (ESL) students, regarding the integration of local culture into English language teaching through AI approaches. Consequently, this present study aimed to use AI approach to

- (1) explore whether local culture should be integrated into ELT in the context of Mekong Delta from the perspectives of students;
- (2) identify what factors should be seriously considered before adopting local-culture–ESL integration;
- (3) provide practical suggestions for successful adoption of local-culture–ESL integration.

The present study aims to answer the following research questions (RQs):

- RQ 1. How do ESL students' perceptions on necessities affect the integration of local culture into English language teaching in the Mekong Delta context?
- RQ 2. Which factors are the most important predictors of ESL students' perceived needs for local culture integration as identified by AI-based models?
- RQ 3. Which AI model can be the best for exploring students' perceived needs for local culture integration?

This work addresses a critical gap in the literature. The results can help university leaders make better decisions when adjusting the curriculum to ensure success of English-major programs. The practical suggestions from this research are expected to support long-term and sustainable development of English-major programs. This study also contributed a novel method to theories on exploring students' perceptions.

2. Background and Literature Review

2.1. Culture and Vietnamese Local Culture

The term “culture”, derived from the Latin “cultura” (meaning cultivation), refers to the transformations created through human actions (Tazhitova et al., 2025). It has been defined in various ways, reflecting the richness and complexity integrated within this universal term. From an anthropological perspective, culture refers to “the forms of traditional behavior which are characteristic of a given society, or of a group of societies, or of a certain race, or of a certain area, or of a certain period of time” (cited in Brumann, 1999). Accordingly, culture is not limited to traditions and customs but also includes social status, gender, age, and patterns of thought (Rojas, 2024). Building on this broader understanding, one of the well-known researchers in linguistic and cultural studies in Vietnam, Thâm (2001) defines culture as a symbolic system of values that humans create and accumulate through practical activities, shaped by their continuous interaction with both the natural and social environment. This perspective highlights the interrelationship between cultural identity and lived realities, and cultural characteristics are deeply rooted in both environmental contexts and collective social experience.

Within the national cultural framework, Vietnamese culture exhibits profound diversity and regional characteristics, which are formed from a combination of ethnic, religious, and traditional occupational elements. In the lower level, local culture, as a form of com-

munity cultural heritage, can both contribute to the local economy and function as a participatory approach to community development. It is expressed through patterns of ritual, art, environmental tourism, mutual cooperation, and cultural tourism (Huraerah et al., 2023). It is more tangible and closely connected to community life, reflecting the unique interaction between people and their geographical environment. Among the various regions of Vietnam, the Mekong Delta represents a particularly illustrative case of cultural diversity and territorial identity. Cultural values in this region have been maintained and developed by different ethnic communities (MOCST, 2023). In addition to the Kinh majority, the region is home to large Khmer and Hoa (Chinese) minorities. The unique languages, religious traditions, festivals, cuisines, and cultural practices of these groups contribute to a multicultural social environment (VCCI, 2021). The long history of harmony of these communities contributed to developing distinctive patterns of intercultural communication and cultural exchange across the region. This diversity may also be seen in educational settings as students are exposed to various perspectives on culture and local identities. Therefore, the Mekong Delta is a significant location to investigate students' perceptions of the integration of local culture into English language teaching and to develop intercultural communication competence in higher education.

2.2. Culture Integration in English Language Teaching

Previous studies have shown that integrating local culture into English language teaching yields significant benefits, particularly in the development of speaking and reading skills. At the secondary education level, incorporating local cultural elements into English skills instructions significantly improves students' communication abilities because learners can use familiar cultural contexts to express ideas more confidently (Suranto et al., 2020; Romrome & Ena, 2022; Auladi & Bakhtiar, 2024). This study emphasizes the link between cultural knowledge and language proficiency in real-world situations. At the university level, integrating local culture contributes to the development of reading comprehension. Studies in China, Malaysia, and South Korea show that the students' language performance and understanding of texts can be improved by connecting new information to their prior cultural knowledge (Yang & Cui, 2020; Nambiar et al., 2020; Alakrash et al., 2021; Kim & Sim, 2024).

Beyond linguistic development, integrating local culture also promotes higher-order thinking, learning engagement, and affective motivation when cultural elements such as daily life, festivals, and social norms are included in instruction (Ratri & Tyas, 2022; Patanduk et al., 2025). Another significant dimension of cultural integration lies in the development of intercultural competence and identity formation. Several studies demonstrate that incorporating cultural elements enhances intercultural awareness and cultural sensitivity among learners. Mede and Gunes (2019) observed a significant increase in students' intercultural awareness when applying the ICC framework in an EFL course. Similarly, research indicates that combining local culture and native English-speaking culture strengthens intercultural competence and communication confidence (Yang & Cui, 2020; Kim & Sim, 2024). In the context of globalization, integrating local culture is also considered an important means of preserving identity and fostering national pride (Darma et al., 2025; Fan et al., 2025). Khasyar et al. (2025) suggests that this process relies on a harmonious bridge between institutional pedagogy and individual elements, particularly the learner's emotional and cultural connection to their hometown identity. These findings are also supported by evidence from a study in the northern part of Vietnam by T. H. M. Nguyen and Nguyen (2022). The integration of local cultural content into English lessons greatly improved students' intercultural communication ability, cultural awareness, and learning motivation. Students also strongly supported the use of local cultural information in English language teaching. These findings indicate that integrating local culture can

be beneficial not only for learners' language development but also for their intercultural competency. In short, when learners understand and critically reflect on their own cultural values, they are better prepared to interact in multicultural settings.

On the other hand, the integration of local culture in English education faces several challenges at institutional and pedagogical levels. One prominent issue is the gap between awareness and practice. Although teachers demonstrate awareness of intercultural communicative competence, practical implementation remains limited (Chau & Truong, 2018). In terms of institutional constraints, exam pressure and rigid curricula often reduce culture to a supplementary component rather than a central focus (Ahmed et al., 2019; Ghavamnia, 2020). In addition, developing culturally integrated materials requires time, expertise, and resources that may not always be available (Ratri & Tyas, 2022). According to Castillo et al. (2025), a lack of basic facilities like the internet and projectors is a major barrier that limits visual cultural lessons. Therefore, Zhang (2022) emphasizes that schools must improve their technology infrastructure so students can easily create videos and presentations about their local culture. Pedagogical challenges also arise when teachers lack clear guidance on how to integrate culture effectively (Mede & Gunes, 2019; T. H. M. Nguyen & Nguyen, 2022). In addition to this instructional challenge, the availability of suitable teaching materials remains a significant concern. Moreover, T. H. M. Nguyen and Nguyen (2022) found that local cultural content was largely absent from English textbooks, with little representation of students' hometown culture, thereby limiting opportunities for meaningful cultural learning. The authors further noted that the strong emphasis on language knowledge and examination-oriented instruction often requires teachers to independently develop and supplement local cultural materials. Regarding the appropriate balance between local culture and target-language culture, Darong and Menggo (2021) warn that excessive emphasis on local culture may limit students' exposure to the communicative norms of English-speaking contexts. Finally, Anugrah et al. (2022) question whether ELT materials should prioritize local or native-language cultures. These issues highlight the need for a balanced and context-sensitive approach to cultural integration.

Overall, integrating local culture into ELT offers both academic and non-academic benefits. However, the gaps between perceptions and practices, resource limitations, program pressures, and debates about cultural balance remain issues that need to be addressed through flexible program design and appropriate policy support.

2.3. AI Approaches to Students' Perception Detection

Artificial intelligence (AI) has become an increasingly influential analytical approach in educational research, particularly in examining students' perceptions and learning behaviors. Supervised machine learning (ML) models such as decision trees, random forests, support vector machines, and neural networks have been widely employed to classify and predict students' responses across diverse educational contexts. Previous studies have demonstrated the effectiveness of these approaches in analyzing student satisfaction in e-learning environments, predicting dropout risks, and identifying key factors influencing learning outcomes (Huynh-Cam et al., 2024b). Compared to traditional statistical methods, AI-based techniques offer stronger capacity to process large-scale datasets and reveal complex, non-linear relationships among variables, thereby providing deeper insights into learners' views and behaviors.

Building on this global trend, the development of artificial intelligence (AI) has been increasingly prioritized in Vietnam, particularly within national digital transformation strategies. The Vietnamese government has identified AI as a key technology for socio-economic development, as stated in the National Strategy on Research, Development, and Application of Artificial Intelligence to 2030 (Government of Vietnam (2021a), Decision No. 127/QĐ-TTg). In the education sector, digital transformation has been further promoted

through the approval of the national scheme on strengthening the application of information technology and digital transformation in education and training for the period 2022–2025, with a vision toward 2030 (Government of Vietnam (2022), Decision No. 131/QĐ-TTg). These policy directions encourage the integration of digital technologies, including AI, to improve teaching quality, data management, and institutional decision-making. As a result, AI-based applications such as learning analytics, student performance prediction, and adaptive learning systems have gradually been introduced in higher education institutions, marking a shift toward more data-informed educational practices.

2.4. Research Gaps

Despite the growing body of research on cultural integration in ELT and AI in education, several important gaps still remain, as highlighted in Table 1.

Table 1. A summary of gaps or controversies in the literature.

Research	Research Purpose	Target Research or Organization	Method Used	Methodological Limitations	Gaps or Controversies	Contributions of This Study
Ahmed et al. (2019)	Local-culture–ESL integration	56 Yemeni EFL teachers from the University of Aden during the academic year 2018	Descriptive	Small sample sizes, lack of diversity	- Does not account for long-term effects - Only explores teachers' perceptions - Lacks holistic ecosystem	(1) Explores students' perceptions towards local-culture-ELT integration in culturally diverse regions like Mekong Delta, serving as a fundamental step in English-major curriculum design/adjusting.
Ghavamnia (2020)	Local-culture–ESL integration	10 Iranian EFL teachers with a PhD degree in Applied Linguistics	Descriptive statistics	Small sample sizes, lack of diversity	- Does not account for long-term effects - Only explores teachers' perceptions - Lacks holistic ecosystem	(2) Uses a larger sample size in four different universities to clarify the needs of local-culture-ELT integration
T. N. A. Le (2023)	Online language learning adoption	EFL students' perceptions during COVID-19 crisis in one university in the Vietnam's Mekong Delta region	Descriptive statistics	Lack of diversity	- Does not explore students' perceptions towards local-culture–ELT integration in culturally diverse regions, serving as a fundamental step in English-major curriculum design/adjusting	(3) Provides practical suggestions for successful adoption of local-culture-ESL integration, contributing to the region's sustainable development and the broader goal of preserving intangible cultural heritage in MDR
Kim and Sim (2024)	Local-culture–ESL integration	39 Korean EFL students of one university	Qualitative	Small sample sizes, lack of diversity	- Lacks the pedagogical models to link subject matter with local traditions - Focuses on only one unique culture like Korean culture	(4) Uses AI approach to analyze student needs

Table 1. *Cont.*

Research	Research Purpose	Target Research or Organization	Method Used	Methodological Limitations	Gaps or Controversies	Contributions of This Study
Huynh-Cam et al. (2024b)	Students' dissatisfaction towards e-learning adoption	499 first-year students in one university in the Vietnam's Mekong Delta region	AI algorithms	Lack of diversity	- Does not explore students' perceptions towards local-culture–ELT integration in culturally diverse regions, serving as a fundamental step in English-major curriculum design/adjusting	
Darma et al. (2025)	Local-culture–ESL integration	42 respondents consisting of teachers and students from various regions in Cirebon	Descriptive qualitative	Small sample sizes	- Does not provide practical suggestions for long-term and sustainable development of local-culture–ESL integration adoption - Lacks holistic ecosystem	
This study	Local-culture–ESL integration	511 Vietnamese EFL students of four universities in Mekong Delta—culturally diverse region—the home to Khmer, Cham, and Hoa ethnic communities	Feature selection and AI algorithms	X	X	

As shown in Table 1, most previous studies have been conducted outside Vietnam, and only a limited number has examined the integration of local culture in Vietnamese English-major programs, making it unclear how well existing findings apply to this context. There is also a lack of research in culturally diverse regions such as the MDR, where multiple ethnic communities create a unique sociocultural environment. This limits the development of context-responsive teaching approaches. Additionally, in higher education, many studies focus mainly on teachers' perceptions, while students' experiences receive less attention, reducing the availability of learner-based evidence for curriculum design. Moreover, although AI has been widely used in education, its application in English language teaching in Vietnam remains limited, particularly in analyzing students' perceptions for needs-based curriculum development. Many studies majorly rely on traditional methods such as descriptive statistics and/or qualitative methods. In addition, there is an absence of systematic, pedagogical models to link subject matter with local traditions and AI approaches to assess and prioritize students' needs. Significantly, the absence of a cohesive can-do syllabus—connecting intercultural communicative competence theory, culturally responsive pedagogy, sociocultural learning theory, and curriculum theory—makes it difficult for practitioners to support effective curriculum adjustment decisions.

To address gaps and/or controversies highlighted in Table 1, this study aimed to apply AI-based classification and feature selection methods to examine ESL students' perceptions of local culture integration in ELT in the MDR—culturally diverse and unique region—the home to Khmer, Cham, and Hoa (Chinese) ethnic communities. Our study addresses the lack of learner-based evidence in curriculum design/adjustment for Mekong Delta, applies AI to analyze student needs, and provides practical support for context-responsive teaching.

3. Methodology

3.1. Research Contexts

The present study was conducted in the academic years 2024–2025 and 2025–2026 under the project funded by Ministry of Education of Vietnam (Acknowledgments) on local-culture and English education integration in the Mekong Delta region where cultural values of 44 different ethnic communities have been maintained and developed (MOCST, 2023). This pilot project will then serve as a practical example for other educational institutions and may lead to decisions in the education sectors at the national level. This project was a cooperation with three other public universities in the Mekong Delta region. Project members officially permitted included the Foreign Languages Faculty of Dong Thap University (DTHU), Can Tho University (CTU), An Giang University (AGU), and Kien Giang University (KGU). The official permission documents were dated on 10 May 2024. These four project members share the same experimental educational contexts. Apart from the same location (i.e., Mekong Delta), all share a common local culture but also have their unique cultural characteristics. The participating universities also recruit students from areas where Kinh, Khmer, Cham, and Hoa (Chinese) communities coexist. Consequently, students may bring diverse cultural experiences, values, and identities into the learning process. This multicultural educational context makes the Mekong Delta particularly suitable for examining students' perceptions of local culture integration in English language teaching and learning.

ESL students of the Foreign Languages Faculty of these four project members are trained to be English teachers and English translators/interpreters. Apart from English language skills, which are more weighted in the curriculum, several major-related subjects such as English teaching pedagogy, English teaching practices in-campus and out-campus (i.e., internship), cross-culture, English culture, American culture, British Literature, American Literature, and English translation are in top priority.

In terms of English proficiency, students in these programs are generally at an intermediate to upper-intermediate level (approximately B1–B2 CEFR), as they have completed several core language skill courses before participating in this study. Language and culture should be combined not only for fostering linguistics competence but also learning motivation and autonomy, cross-disciplinary integration, and local culture awareness and reservations (Ahmed et al., 2019; Ratri et al., 2024; Matsuda & Watanabe, 2026). Given the mutually beneficial aspects and strong interdisciplinary connections within the current curriculum across experimental educational contexts, integrating local culture into ELT is essential. Yet, how local culture is viewed and taught in the English language curriculum and the corresponding classrooms should be a considerable issue (Do, 2020; Trinh & Nguyen, 2025). Additionally, in the context of ELT in Mekong Delta, where teaching and learning facilities are limited, there seems to be a greater emphasis on English language skills and single subjects, while local culture has not received adequate attention. This practice is also limited in research (Do, 2020; H. N. Le et al., 2026). There is limited knowledge about how local culture should be integrated into ELT in theories and practices in the context of Vietnam's Mekong Delta region.

Regarding technological readiness, in the Mekong Delta context, where infrastructure and facilities have been deemed unqualified or inadequate (T. N. A. Le, 2023; Huynh-Cam et al., 2024a), applications of AI and AI algorithms have emerged as a very new tool, challenging educational stakeholders. Students have basic familiarity with digital learning tools, such as learning management systems and online resources. However, their knowledge of AI in education is still limited and mostly informal, often based on personal use of common AI tools rather than formal instruction. Notably, formal courses related to digital technology and AI have only been officially introduced into the curriculum since the fourth quarter of 2025 in the participating universities. In contrast, lecturers in these institutions have

received initial training on the use of AI in teaching and research since early 2025, which may influence the direction of curriculum development and classroom practices. Across the four universities, the level of technological infrastructure and access to digital tools is moderate, with some limitations typical of regional institutions in the Mekong Delta. These conditions provide a realistic context for examining students’ perceptions of AI-supported approaches in English language teaching and research. This context also highlights the timeliness of the present study in capturing students’ initial perceptions toward AI integration in ELT. The findings may provide practical implications for educational stakeholders. This pilot study is performed in the context of Vietnam’s Mekong Delta region to use AI algorithms for their teaching, learning, research, and decision making. It also contributes to technology anxiety reduction for educational stakeholders in this region.

Academic curriculum and syllabus and learning resources should be updated in order to meet this requirement. Curriculum changes need to be based on needs analysis (Macalister & Nation, 2019). This means schools should carefully listen to students’ present voices and future career goals. This study served as the first phase in this project, namely pre-experiment phases, which conducted a needs analysis step from students’ perceptions.

3.2. Proposed Implementation Process

The present pilot study adapted a quantitative method to explore ESL students’ perceptions on integrating local culture in English language teaching, employing two AI algorithms: DT and SVM—supervised ML algorithms. Figure 1 depicts the 8-step implementation process, adjusted from Huynh-Cam et al. (2024b) and L. S. Chen et al. (2025). The corresponding tasks in each step will be described in detail in the following sub-sections.

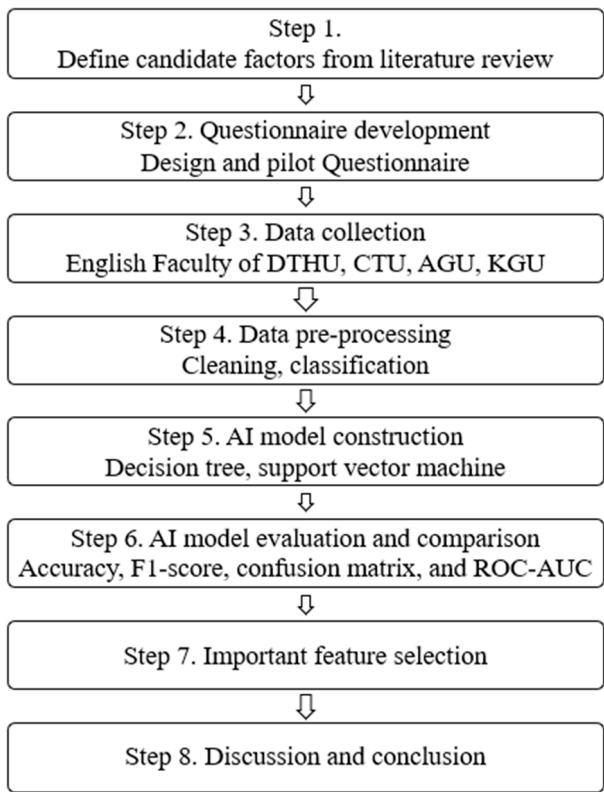


Figure 1. Implementation process of the AI-based feature selection proposed method.

3.2.1. Step 1: Define Candidate Factors from the Literature Review

Before designing a questionnaire, we conducted a literature review on current research in order to define candidate factors of culture–ELT integrations based on published studies

and practices in the current curriculum across four target universities. After this review, five factors were defined, as shown in Table 2. These factors served as candidate factors and a basic framework for designing a questionnaire in this study.

Table 2. Candidate factors for local-culture–ELT integrations.

No.	Dimensions	Description	Reference
1	Demographics	Major, hometown, year of enrolment	Mede and Gunes (2019)
2	Local-culture integration level	Local culture content, subjects in which local culture is integrated	Azizah et al. (2021)
3	Facilities	Facilities and technology supporting local-culture–ELT integrations	Khan et al. (2017)
4	Curriculum-related factors	English proficiency, listening skills, speaking confidence, vocabulary acquisition, writing skills, translations, etc.	Fan et al. (2025) ; current curriculum of Teacher Education and English Linguistics at AGU, CTU, DTHU, and KGU
5	Higher-level learning	Critical thinking, intercultural competence, learner engagement, global competence, cultural awareness, cultural pride, cultural preservation, community engagement, communication skills, etc.	

3.2.2. Step 2: Questionnaire Development

We designed a 2-part electronic questionnaire (EQ). Part 1 was for ESL students' basic information and Part 2 was for research analysis. The initial EQ was piloted via emails with two separate groups who have experienced local-culture–ELT integration in the target educational contexts. Group A had five experts, and Group B comprised ten students. Feedback from these two groups served as the basis for questionnaire item revision. Based on their feedback, three items were removed due to duplication, ambiguous semantics, or being unsuitable for the experiment contexts. Two items were also added. The modified EQ was sent back to these groups for their confirmation. The final EQ in total comprised 32 items (Section 4.2). The language used was Vietnamese for target respondents' ease of understanding. The time allotted for responding was approximately fifteen minutes.

3.2.3. Step 3: Data Collection

The EQ was distributed to all full-time bachelor students in four target universities in the Mekong Delta region in Vietnam between September and October 2025 and administered by teachers in charge of the English courses. Hence, duplicated responses and unauthorized respondents were avoided. Students' identity also remained anonymous for ethical reasons, to ensure a higher response rate, and for biased-response reduction. Respondents evaluated the agreement level via a 5-point Likert scale anchored at 1 (absolutely disagree) to 5 (absolutely agree).

3.2.4. Step 4: Data Preprocessing

We used Microsoft 2019 software to preprocess the raw collected data. First, we excluded all samples with missing values or invalid responses (i.e., all items evaluated by a single point). This resulted in a final size of 511 samples for further analysis. For input factors, we generated questionnaire-item content for ease of interpretation and complex reduction (Section 4.2).

Next, for the output factor “needs”, we excluded number 3 (neither agree nor disagree), as we emphasized no-need or need, and combined 1 (absolutely disagree) and 2 (disagree) as well as 4 (agree) and 5 (absolutely agree) to create two new classes, “no-need” (i.e., disagree) and “need” (i.e., agree), as they are similar. Among 511 finalized sample sizes, 427 samples belong to the “need” class, and 37 samples are for the “no-need” class.

Finally, we used the output factor “needs” as a class label to distribute the dataset into three classification cases for better accuracy. Case A used the original dataset as a baseline for comparison. To address class imbalance, Case B applied an under-sampling method and Case C employed random oversampling methods, adjusted from [Chang et al. \(2019\)](#), [Huynh-Cam et al. \(2025\)](#), and [L. S. Chen et al. \(2025\)](#). The dataset was first randomly partitioned into a training set (80%) and an independent, unseen testing set (20%). To prevent data leakage, all subsequent preprocessing and modeling steps were performed strictly on the training set. Furthermore, the resampling techniques were applied exclusively to the training data, leaving the testing set entirely isolated from the process.

3.2.5. Step 5: AI Model Construction

The present study employed a 5-fold cross validation (CV) experiment based on the decision tree (DT) and support vector machine (SVM) algorithms. This means that the preprocessed dataset was divided into 5 equal-sized data folds with the ratio 80:20. Every data fold took turns to be used as the testing set while the other four folds were used as the training sets to build DT and SVM models. The fold having the highest classification performance was selected for further analysis.

The DT and SVM are two of the most popular algorithms for classification and regression in the domain of data mining and machine learning ([Huynh-Cam et al., 2025](#)). Compared to other supervised learning algorithms, DT was successfully used in educational fields owing to its high accuracy prediction, simple use, and easy understanding and interpreting for knowledge representation ([Park & Dooris, 2020](#); [Huynh-Cam et al., 2025](#)). DT can be visualized in an understandable manner and be clearly interpreted through visualized models. SVM provides the margin maximization and nonlinear classification. SVM has evidently been effective in many real-world applications ([Naicker et al., 2020](#)). This success suggests DT and SVM models for this study. We constructed both DT and SVM models in Python 3 (ipykernel) language, version 6.5.4, that are available at <https://jupyter.org/> (accessed on 2 January 2026) and <https://scikit-learn.org/stable> by the following sub-steps (accessed on 2 January 2026).

1. Creating 5 folds of training-testing data (80:20).
2. Setting parameters for each model available at https://scikit-learn.org/stable/supervised_learning.html (accessed on 2 January 2026).
3. Processing training, testing, and cross validation.
4. Evaluating performance using evaluation metrics (Step 5).
5. Repeating steps 1–4 for 5 data folds.
6. Comparing performance among three classification cases (Step 3) using the mean and standard deviation (SD) values.

The case and data fold having the highest classification performance were then chosen for selecting influential factors. The implication results for each case will be presented in Section 4.

3.2.6. Step 6: AI Model Evaluation and Comparison

Four evaluation metrics—overall accuracy, F1-score, confusion matrix, and ROC-AUC—were utilized to examine classification performance of two AI models.

(1) Overall accuracy: we generally evaluated and compared the mean and SD values of overall accuracy among three classification cases. However, relying solely on overall accuracy may lead to misinterpretation owing to the imbalanced data presences ([Chang et al., 2019](#); [M. Y. Chen et al., 2022](#); [L. S. Chen et al., 2025](#)). The models can classify the majority class and ignore the minority class. Thus, more following evaluation methods were used.

(2) F1: in the next step, we evaluated and compared the mean and SD values of F1 for the minority “no-need” (positive) and majority “need” (negative) classes among three classification cases. F1 value was used as it provides a more reliable performance metric for imbalanced datasets, emphasizing the performance of the minority class and showing whether the AI models actually detect the target class (i.e., “no-need”) (Yacouby & Axman, 2020). Even though F1 is one of the most popular methods in the field of machine learning, it may fail in providing a full picture of how well the AI models classify both classes and may cover details about errors (False Positive and False Negative). Thus, a confusion matrix was used to overcome this disadvantage.

The accuracy and F1-score equations are as follows:

$$\text{Overall accuracy} = \frac{TP + TN}{TP + TN + FN + FP} \quad (1)$$

$$F1 = \frac{2 * (TP / (TP + FN)) * (TP / (TP + FP))}{(TP / (TP + FN)) + (TP / (TP + FP))} \quad (2)$$

(3) Confusion matrix: was used to examine how well the models classify both classes: minority “no-need” and majority “need”. The parameters of the confusion matrix were described in Table 3.

Table 3. Confusion matrix.

Predicted Actual	No-Need	Need
No-need	True Positive (TP)	False Negative (FN) = Error
Need	False Positive (FP) = Error	True Negative (TN)

(4) ROC-AUC: was used to evaluate how well the models rank the examples (Muschelli, 2020; Huynh-Cam et al., 2024b; L. S. Chen et al., 2025). It ranges from 0.5 to 1.0, where 0.5 refers to random chance and 1.0 represents perfect classifier. The higher AUC means that the models are better at classifying two classes.

3.2.7. Step 7: Important Feature Selection

After comparisons in Step 5, important scores were applied to rank all features. The features having the highest importance scores were selected as the most important features.

3.2.8. Step 8: Discussion and Conclusion

This step discusses the research findings, provides practical suggestions, as well as highlights conclusions, limitations, and roadmaps for future studies.

3.3. Samplings

After preprocessing the collected data, out of 532 electronic questionnaires initially delivered, 511 (96%) received responses were valid for further analysis. The remaining responses were not included as they contained missing values or invalid responses (i.e., all items evaluated by a single point). Figure 2 shows the numbers and percentage of the selected samples across the four universities. Table 4 presents demographic characteristics of these participants. For clarity, the data are grouped into three categories: location (city and countryside), academic major (English Teacher Education and English Linguistics), and year level (Year 1 to Year 4).

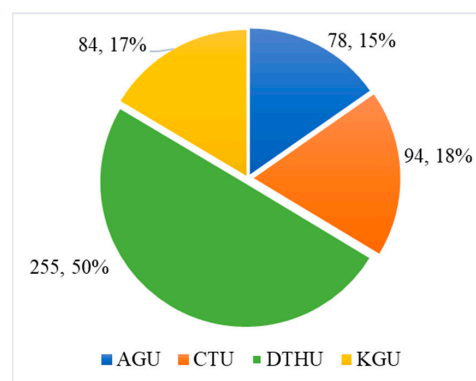


Figure 2. Numbers of selected samples across four universities ($n = 511$).

Table 4. Descriptive statistics of the selected samples ($n = 511$).

Category	Values	AGU	CTU	DTHU	KGU	Total
Location	City	26	34	24	34	118
	Countryside	52	60	231	50	393
Major	English Teacher Education	47	39	84	0	170
	English Linguistics	31	55	171	84	341
Year level	Year 1	0	0	163	0	163
	Year 2	0	39	34	0	73
	Year 3	47	55	20	48	170
	Year 4	31	0	38	36	105

In general, most participants are from the countryside and are enrolled in English Linguistics programs. The sample also includes students from all four academic levels, although the distribution is not equal across universities.

4. Results

4.1. Data Preprocessing

For better classification performance, we conducted two re-sampling methods: under-sampling and oversampling technique, adjusted from [Chang et al. \(2019\)](#), [L. S. Chen et al. \(2025\)](#), and [Huynh-Cam et al. \(2025\)](#). Figure 3 displays numbers of ESL students in these cases:

- Case A, namely origin, used the original output: “need” and “no-need” classes without applying any resampling methods as a basic comparison.
- Case B, namely under-sampling, randomly reduced the majority class “need” until it equaled the minority class “no-need” without changing any things in the minority class.
- Case C, namely oversampling, oversampled the minority class “no-need” until it equaled the majority class “need” without changing any things in the majority class.

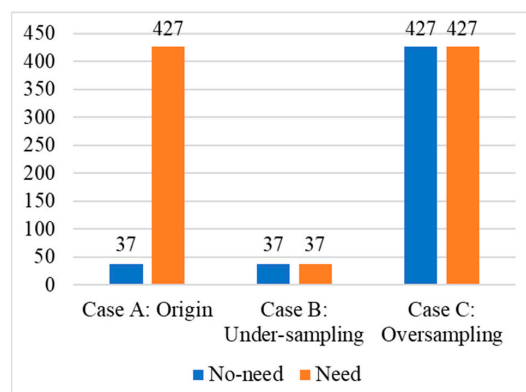


Figure 3. Numbers of ESL students in the three classification cases ($n = 511$).

In short, DT and SVM models were built for the three classification cases (Figure 3). Each model was built for each case using a 5-fold CV. The experiential results for each case will be reported in the following sub-sections.

4.2. Input and Output Features

A total of 32 features were generated from the questionnaire items and used as input variables for building prediction models in this study. These features are grouped into five dimensions, including students' background information, learning conditions, local culture integration (LCI), local culture (LC), and learning outcomes. For clarity, several abbreviations are used. LCI (Local Culture Integration) refers to the extent to which local cultural content is incorporated into English language teaching. LC (Local Culture) reflects students' awareness, values, and learning activities related to local cultural elements. ICC (Intercultural Communicative Competence) describes students' ability to communicate effectively across different cultural contexts. As computers only understand numeric values, we also coded category values of three features—hometown, major, year—into numeric ones as shown in Table 4.

The output factor is the “need” factor, which is defined as a binary classification with two classes: “no-need” (0) and “need” (1). Table 5 presents the full list of input features, together with their mean values, standard deviations, and corrected item–total correlations.

The descriptive statistics in Table 5 indicate that students generally show positive perceptions toward the integration of local culture into English language teaching. The mean scores of items related to local culture integration (LCI and LC) range from approximately 2.9 to 4.2, with standard deviations ranging from 0.9 to 1.0, suggesting a moderate to relatively high level of agreement among participants. Items related to curriculum integration and learning activities (e.g., LC-curriculum and LCI-related features) tend to have higher mean values, indicating that students recognize the importance of including local cultural content in formal learning structures. Meanwhile, items associated with practical application (such as teaching practice and reading activities) also show consistent agreement, although with slightly higher variability, reflecting differences in students' learning experiences. In summary, the results suggest that students not only acknowledge the value of local culture in language learning but also perceive it as a meaningful component of their academic development. However, the variation in standard deviations indicates that these perceptions are not uniform and may be influenced by individual learning contexts and academic levels.

Table 5. Input factor description ($n = 511$).

ID	Features (Generated from Questionnaire Items)	Mean	SD	Corrected Item–Total Correlation
OUTPUT (class label): Need = 1; No-need = 0				
X1	Hometown (City = 1; Countryside = 2)			
X2	Major (English Teacher Education = 1; English Linguistics = 2)		N/A	
X3	Year (Year 1 = 1; Year 2 = 2; Year 3 = 3; Year 4 = 4)			
X4	Level LCI_Listening	3.1	0.9	0.42
X5	Level LCI_Speaking	3.3	0.8	0.48
X6	Level LCI_Reading	3.2	0.9	0.44
X7	Level LCI_Writing	3.1	0.9	0.48
X8	Level LCI_Presentation	3.3	0.8	0.49
X9	Level LCI_Cultural_Ex	3.3	0.9	0.49
X10	Level LCI_Oral Translation	3.0	0.9	0.42
X11	Level LCI_Written Translation	2.9	0.9	0.42
X12	Level LCI_Teaching_Method	3.1	1.0	0.48
X13	Level LCI_Teaching Practice	3.0	1.0	0.38
X14	Facilities	3.7	1.0	0.40
X15	Lab_rooms provided	3.7	1.0	0.41
X16	LC_curriculum	4.0	0.9	0.44
X17	LC_Topic	4.2	0.7	0.73

Table 5. Cont.

ID	Features (Generated from Questionnaire Items)	Mean	SD	Corrected Item–Total Correlation
X18	LC_value	4.2	0.7	0.72
X19	LC_Awareness	4.2	0.7	0.68
X20	LC_promotion	4.2	0.7	0.67
X21	LC_Activities	4.1	0.7	0.70
X22	English_proficiency	4.0	0.7	0.71
X23	Listening	4.2	0.7	0.69
X24	Speaking	4.1	0.7	0.69
X25	Vocabulary	4.1	0.7	0.71
X26	Writing	4.1	0.7	0.69
X27	Critical_thinking	4.0	0.7	0.71
X28	Learning	4.0	0.7	0.70
X29	Responsibilities	4.1	0.7	0.72
X30	ICC	4.1	0.7	0.71
X31	Curriculum_Development	4.1	0.7	0.60
X32	Skills	4.1	0.7	0.71

Note: For features X4~X32, 1 = absolutely disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = absolutely agree.

4.3. Results of Classification

4.3.1. Overall Results of Classification Cases

This study focused only on the minority class “no-need”; thus, this class is prioritized for comparison and discussion. In the first step, we generally examined the accuracy performances of both AI models built in three classification cases. Table 6 compares the accuracy results for these cases.

Table 6. Accuracy results of three classification cases.

Classification Cases	AI Model	Fold 1	Fold 2	Fold 3	Fold 4	Fold 5	Mean	SD
Case A: Origin	DT	82.0	87.0	91.0	84.0	85.0	85.80	3.42
	SVM	96.0	95.0	94.0	96.0	94.0	95.00	1.00
Case B: Under-sampling	DT	47.0	73.0	47.0	73.0	40.0	56.00	15.78
	SVM	67.0	80.0	80.0	67.0	60.0	70.80	8.87
Case C: Oversampling	DT	98.0	96.0	98.0	99.0	96.0	97.40	1.34
	SVM	92.0	89.0	93.0	94.0	92.0	92.00	1.87

For Case A with the original dataset, the mean (standard deviation) values are 85.80% (3.42) for DT and 95.00% (1.00) for SVM. For Case B, the accuracy results for both DT and SVM decrease significantly from 85.80% to 56% (15.78) and 95.00% to 70.80% (8.87), respectively. Consequently, we conducted Case C, namely oversampling, in which the minority class “no-need” was randomly oversampled until it equaled the majority class “need” without changing any things in the majority class. Case C was expected to gain higher performance.

As also seen in Table 6, for Case C, the overall accuracy value of both DT and SVM increase to 97.40% (1.34) and 92.00% (1.87), respectively. Generally, both models built in this case surpass those in Cases A and B. Yet, it is suspected that the DT and SVM models biased the majority class and ignored the minority one (Chang et al., 2019). Hence, we evaluated F1-score in the next step.

Table 7 shows the F1 values of all three classification cases. For Case A, it is found that F1-score for DT is 19.20% (16.66) and for SVM is 48.00% (15.25) in classifying the minority class “no-need” even though this score for the majority class “need” is over 90%. This means that both models cannot classify the minority class “no-need” correctly. The high accuracy results from the imbalanced class problem in which both models bias the majority class and almost ignore the minority one. Since these models cannot achieve an acceptable performance and meet the research purposes, we conducted Case B.

Table 7. F1 results of three classification cases.

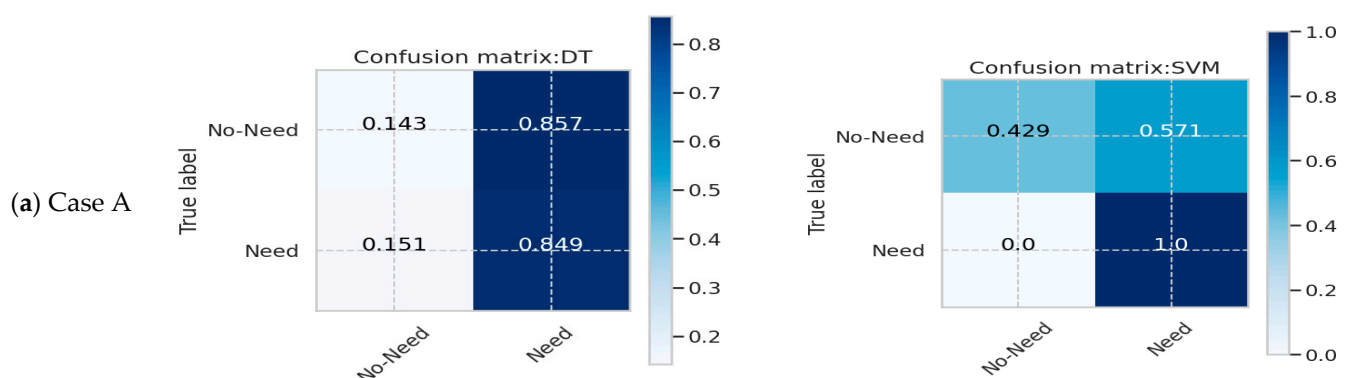
Classification Cases	AI Model	Classes	Fold 1	Fold 2	Fold 3	Fold 4	Fold 5	Mean	SD
Case A Origin	DT	No-need	11.0	40.0	33.0	0.0	12.0	19.20	16.66
		Need	90.0	93.0	95.0	91.0	92.0	92.20	1.92
	SVM	No-need	60.0	55.0	25.0	60.0	40.0	48.00	15.25
		Need	98.0	97.0	97.0	98.0	97.0	97.40	0.55
Case B Under-sampling	DT	No-need	50.0	71.0	50.0	75.0	40.0	57.20	15.06
		Need	43.0	75.0	43.0	71.0	40.0	54.40	17.08
	SVM	No-need	62.0	80.0	77.0	62.0	50.0	66.20	12.30
		Need	71.0	80.0	82.0	71.0	67.0	74.20	6.46
Case C Oversampling	DT	No-need	98.0	96.0	98.0	99.0	97.0	97.60	1.14
		Need	98.0	96.0	98.0	99.0	96.0	97.40	1.34
	SVM	No-need	91.0	88.0	93.0	93.0	92.0	91.40	2.07
		Need	92.0	89.0	93.0	94.0	92.0	92.00	1.87

For Case B, the F1 scores for the class “no-need” significantly rise from 19.20% up to 57.20% (15.06) for the DT model and from 48.00% up to 66.20% (12.30) for SVM. However, it is suspected that the characteristics of the minority class could be lost.

For Case C, it is clear that F1-scores of both classes increase steadily to over 90% for both the DT and SVM models. This means that two models built in Case C can classify both classes “no-need” and “need” correctly. Between the two models, DT performs better than SVM with an F1-score of 97.60% (1.14) for “no-need” and 97.40% (1.34) for “need” classes. Among five folds of data, fold 4 gains lightly better performance with an F1-score of 99%. Hence, fold 4 built in Case C will be used for in-depth comparisons.

4.3.2. Comparisons on Classification Results

For in-depth comparisons on DT and SVM models’ performance among three classification cases, we judged the results of the confusion matrix and ROC-AUC. Figure 4 displays these results. As seen in Figure 4a for Case A, the minority class “no-need” is very lowly classified as 14.3% (DT) and 42.9% (SVM), although the majority class “need” is highly classified as 84.9% for DT and 100% for SVM. The errors in classification for the class “no-need” are very high, accounting for 85.7% (DT) and 57.1% (SVM). This indicates that both DT and SVM models built in Case A cannot recognize the minority class “no-need” correctly.

**Figure 4.** Cont.

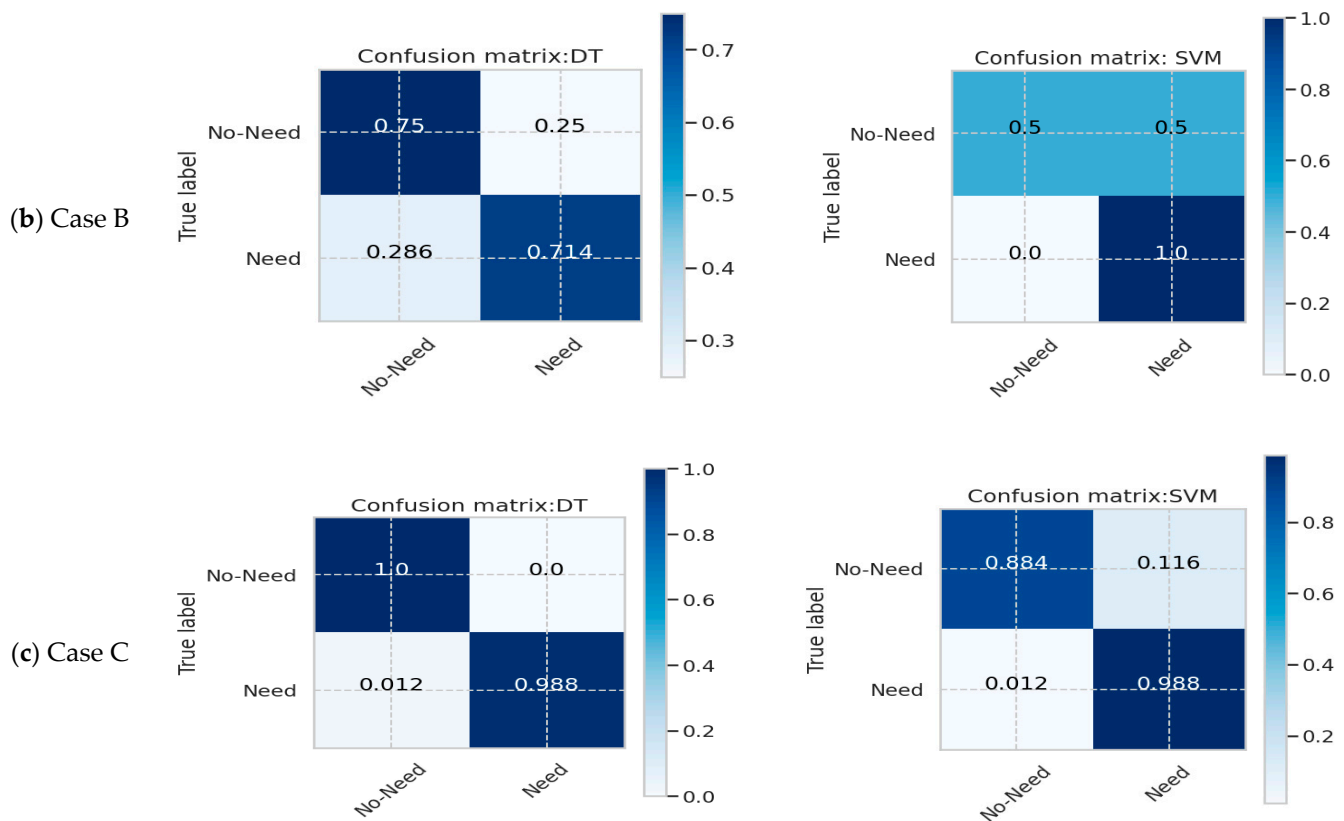


Figure 4. Comparisons on confusion matrix results among three cases (fold 4).

For Case B with under-sampling data as shown in Figure 4b, the classification for the minority class “no-need” steadily increases from 14.3% in Case A to 75% (DT) and to 50% (SVM). For Case C, as displayed in Figure 4c, DT can classify the “no-need” class as 100%, whereas SVM does this as 88.4%. The errors in classification for the class “no-need” are very low compared to Cases A and B, accounting for 0.0% (DT) and 11.6% (SVM).

Figure 5 shows the ROC-AUC values of three classification cases. The dashed blue line in Figure 5 represents an AUC (Area Under the Curve) value of 0.5. It maps where the True Positive Rate (TPR) exactly equals the False Positive Rate (FPR) across all classification thresholds, serving as a visual benchmark for model evaluation. A truly useful AI models must perform better than this line. It is obvious that DT and SVM models built in Case C outperformed those built in cases A and B. DT surpasses SVM with a ROC-AUC value of 0.99.

To judge F1-score and ROC-AUC results, it is advisable that DT and SVM models built in Case C outperform at classifying two classes: “no-need” and “need”. Between these two models, the DT model performs slightly better than the SVM. Hence, DT is selected to rank importance features based on the features’ importance scores.

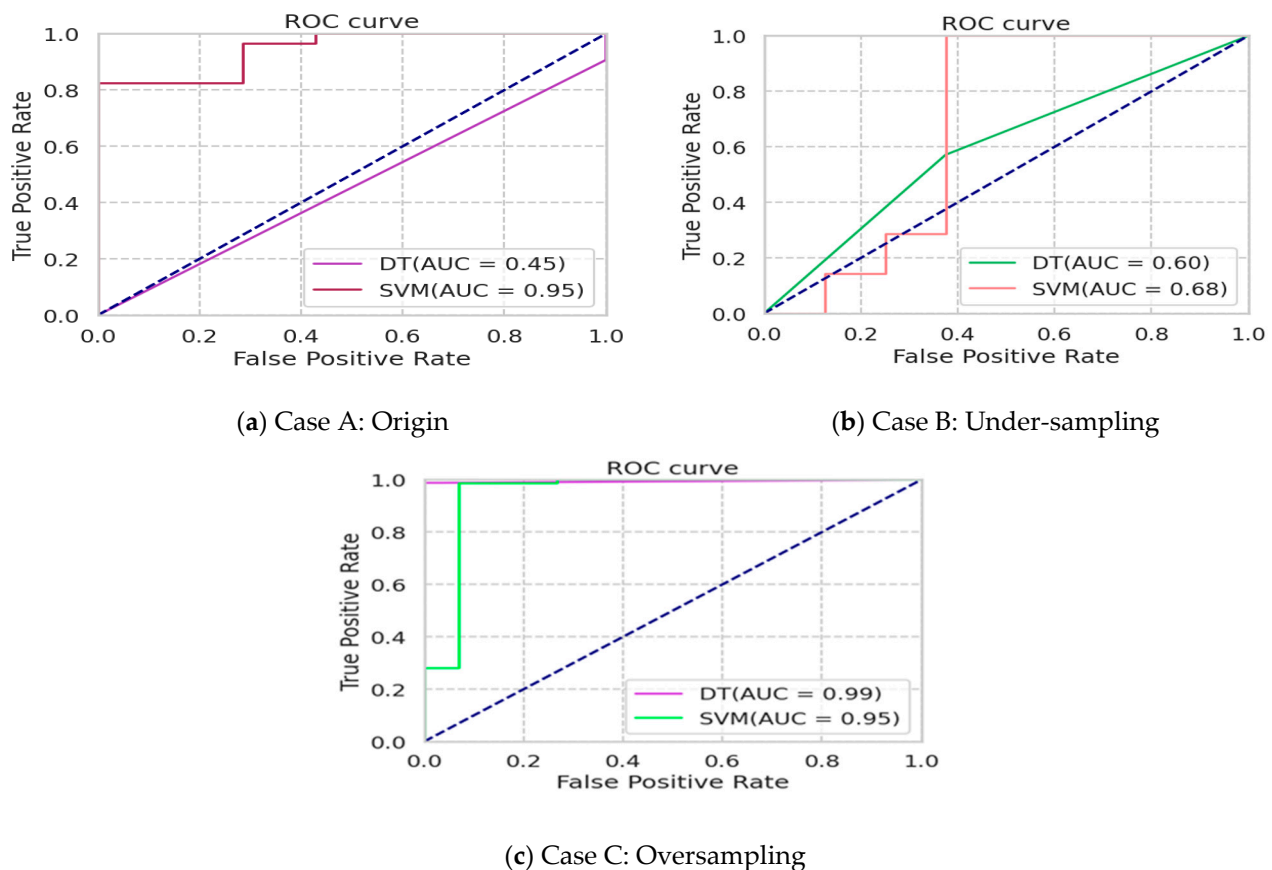


Figure 5. Comparisons on the ROC-AUC values among three cases (fold 4).

4.4. Results of Feature Importance

4.4.1. Overall Results

In practice, the classification models built in Case C are more meaningful than the models built in Case A and Case B. Thus, we emphasized the results of Case C: Oversampling. We used the importance scores of the DT algorithm since it performs slightly better than the SVM model to select important features for ESL students' perceptions of local-culture–English language teaching integrations. In the first step, we visualized feature importance rankings of all factors in the combined major dataset for general comparison. Figure 6 displays the ranks of all features based on their importance scores. Obviously, the feature X16 (LC_curriculum) occupies the top position with a very high score, indicating that this feature is very important and significantly impacts decisions about whether it is necessary to integrate local culture into English language teaching in the context of Vietnam's Mekong Delta region.

In the next step, for further comparison, we ranked all features based on their importance scores. Table 8 lists the feature importance rankings of these factors. As shown in this table, the top-five factors include X16 (LC_curriculum), X3 (year), X13 (Level LCI_Teaching Practice), X15 (Lab room), and X17 (LC_Topic) with an importance score of 0.321, 0.086, 0.060, 0.056, and 0.051, respectively. All factors having a score of ≥ 0.037 were selected to compare with those in two data subsets for validation. After comparing and validation, the top-ranking factors were selected as finalized important factors based on frequency occurrence among three datasets. Table 7 compares feature importance values among these datasets.

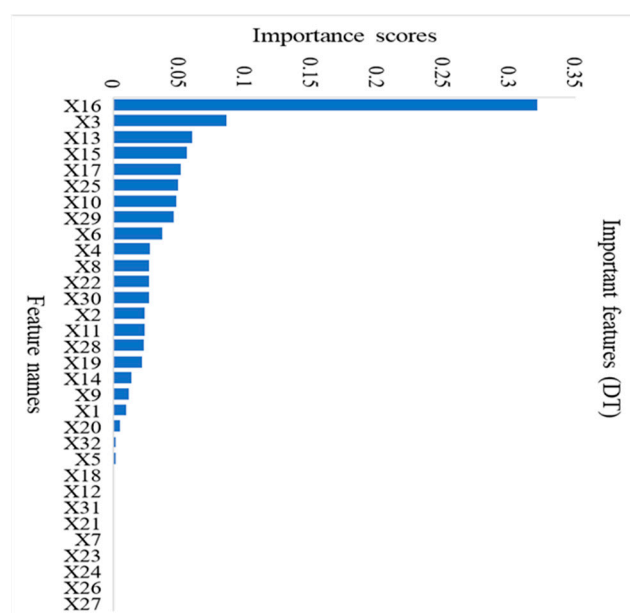


Figure 6. Feature importance rankings of all factors (combined-majors dataset).

Table 8. Rankings of feature importance of the combined-majors dataset.

Rank Order	ID	Feature Importance Values	Rank Order	ID	Feature Importance Values
1	X16	0.321	17	X19	0.022
2	X3	0.086	18	X14	0.014
3	X13	0.060	19	X9	0.012
4	X15	0.056	20	X1	0.010
5	X17	0.051	21	X20	0.005
6	X25	0.049	22	X32	0.002
7	X10	0.048	23	X5	0.002
8	X29	0.046	24	X18	0.000
9	X6	0.037	25	X12	0.000
10	X4	0.028	26	X31	0.000
11	X8	0.027	27	X21	0.000
12	X22	0.027	28	X7	0.000
13	X30	0.027	29	X23	0.000
14	X2	0.024	30	X24	0.000
15	X11	0.024	31	X26	0.000
16	X28	0.023	32	X27	0.000

4.4.2. Feature Importance/Methodological Validation

For the research purposes, this pilot study is expected to understand what students of English Teaching Education and English Linguistics majors need for integrating local culture into English teaching before conducting curriculum updates in order to satisfy students' needs and social requirements. Thus, we separated the dataset of combined majors into two data subsets. Data subset 1 (D1) is for students of the English Teaching Education (ETE) major. Data subset 2 (D2) is for students of English Linguistics (EL). These two data subsets were used as an independent holdout validation dataset. These data were completely isolated during the model training process. We focused on major instead of university since, in practice, major is more meaningful for curriculum updates and for satisfying students' needs, often considered as universities' customers (Huynh-Cam et al., 2024c; 2024b) and social requirements. University focus seems not to be meaningful, as they share similar curriculum and educational context in the Mekong Delta region. Figure 7 displays the numbers of students in D1 and D2 after preprocessing (Section 3.2, Step 4).

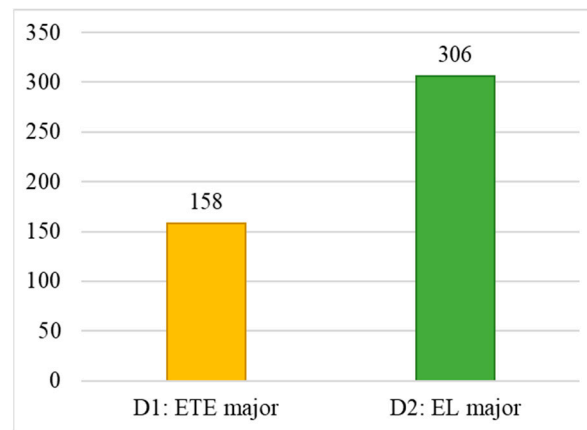


Figure 7. The numbers of students in each data subset used for validation (after preprocessing).

Figures 8 and 9, and Table 9 display the ranks of all features based on their importance scores of two data subsets. Obviously, in D1 (ETE major), the feature X15 (Lab room) occupies the top position with a very high score as shown in Figure 8; in D2 (EL major), the feature X16 (LC_curriculum) gains a very high importance score as displayed in Figure 9. It can be inferred that ETE students may think that lab rooms play important roles in local-culture–ETE integrations, whereas EL students believe that local culture curriculum is important. For better validation and ease of interpretation, all factors with an importance score of 0.0 in D1 and D2 were excluded in further analysis due to their meaninglessness. Table 9 lists the feature importance rankings of these two data subsets.

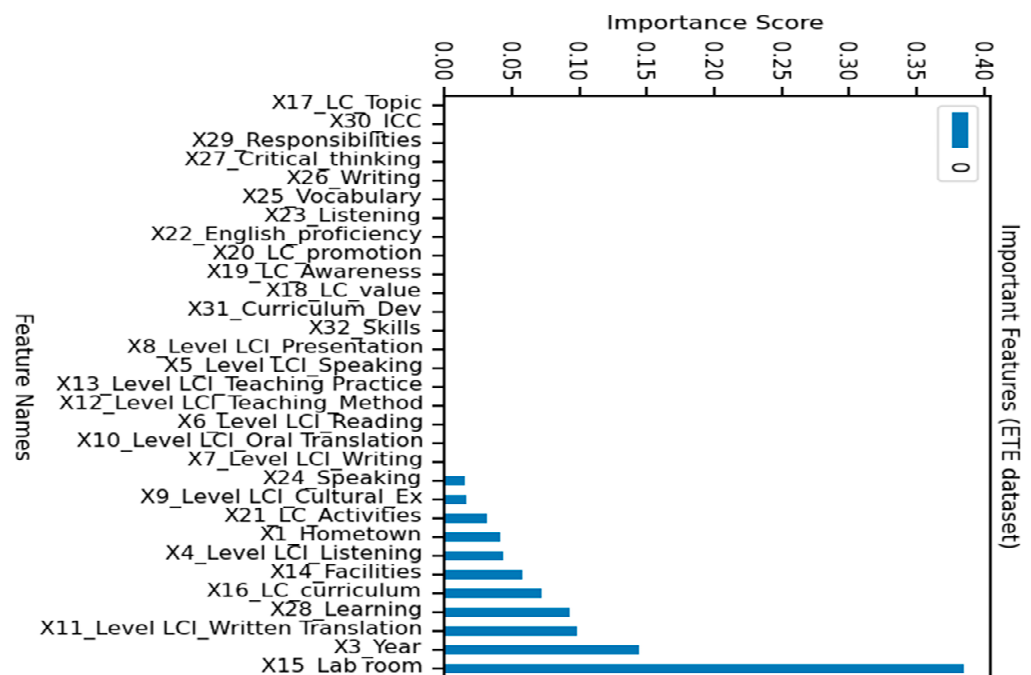


Figure 8. Feature importance rankings of Data subset 1 (D1): ETE major.

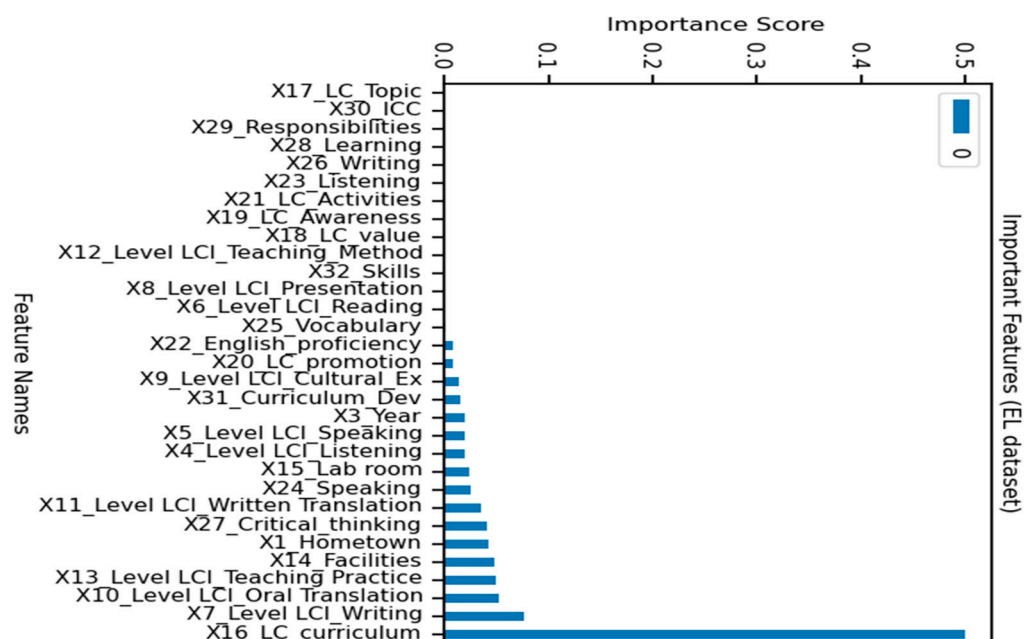


Figure 9. Feature importance rankings of Data subset 2 (D2): EL major.

Table 9. Feature importance rankings of two data subsets.

Rank Order	D1: ETE Major		D2: EL Major	
	Feature Name	Feature Importance Values	Feature Name	Feature Importance Values
1	X15_Lab room	0.385	X16_LC_curriculum	0.500
2	X3_Year	0.145	X7_Level LCI Writing	0.077
3	X11_Level LCI Written Translation	0.098	X10_Level LCI Oral Translation	0.052
4	X28_Learning	0.093	X13_Level LCI Teaching Practice	0.049
5	X16_LC_curriculum	0.072	X14_Facilities	0.048
6	X14_Facilities	0.058	X1_Hometown	0.043
7	X4_Level LCI Listening	0.043	X27_Critical thinking	0.042
8	X1_Hometown	0.042	X11_Level LCI Written Translation	0.036
9	X21_LC_Activities	0.032	X24_Speaking	0.025
10	X9_Level LCI Cultural_Ex	0.017	X15_Lab room	0.024
11	X24_Speaking	0.015	X4_Level LCI Listening	0.021
12			X5_Level LCI Speaking	0.020
13			X3_Year	0.020
14			X31_Curriculum_Dev	0.016
15			X9_Level LCI Cultural_Ex	0.013
16			X20_LC_promotion	0.008
17			X22_English_proficiency	0.008

For better validation, we compared importance scores of all factors across datasets—combined-major dataset, D1 (ETE major), and D2 (EL major). All factors having a score of ≥ 0.042 were selected to compare and finalize the most important factors based on importance score and occurrence frequency across two or three types of datasets. The factor appearing in all datasets was in priority for further analysis.

After comparing and validation, the top-ranking factors were selected as finalized important factors based on frequency occurrence among two or three datasets. Table 10 compares feature importance values among these datasets.

Table 10. The important feature rankings of ETE and EL majors and finalized important factors.

Rank Order	Combined Majors		D1: ETE Major		D2: EL Major		Most Important Factors *	
	ID No.	Importance Score	ID No.	Importance Score	ID No.	Importance Score	ID No.	Factor Name
1	X16	0.321	X15	0.385	X16	0.500	X16	LC-curriculum Facilities Hometown
2	X3	0.086	X3	0.145	X7	0.077	X14	
3	X13	0.060	X11	0.098	X10	0.052	X1	
4	X15	0.056	X28	0.093	X13	0.049		
5	X17	0.051	X16	0.072	X14	0.048		
6	X25	0.049	X14	0.058	X1	0.043		
7	X10	0.048	X4	0.043	X27	0.042		
8	X29	0.046	X1	0.042				

* Note: selected based on importance score and occurrence frequency across datasets.

5. Discussion

Table 10 lists the top three features contributing to the students' perceptions on the necessities for the adoptions of local-culture–ELT integrations. The top-to-bottom features include (local-culture curriculum) LC-curriculum (X16), Facilities (X14), and Hometown (X1). These results are generally consistent with previous research on cultural integration in ELT such as [Ratri and Tyas \(2022\)](#), [T. H. M. Nguyen and Nguyen \(2022\)](#), [Ratri et al. \(2024\)](#), [Khasyar et al. \(2025\)](#), [Castillo et al. \(2025\)](#), and [Matsuda and Watanabe \(2026\)](#). Theoretically, the findings of this study closely link to intercultural communicative competence theory, culturally responsive pedagogy, sociocultural learning theory, and curriculum theory. They also confirm that the three elements—curriculum, facilities, hometown—are strongly interrelated, which ensures the successful adoption of local-culture integrations in ELT. Vietnam's Mekong Delta region is the home of Kinh, Khmer, Cham, and Hoa (Chinese) ethnic communities, serving as a rich repository of indigenous wisdom and regional identity. These groups frequently blend their traditions and knowledge in rural settings. The local-culture–ELT integration can enhance students' learning motivation, strengthen their sense of cultural identity, encourage English usage in contexts which are relevant to their lives ([Darma et al., 2025](#)), and preserve intangible cultural heritage.

First, LC-curriculum (X16) emerges as the strongest predictor, highlighting the central role of curriculum design in shaping students' perceptions of local culture integration. This factor closely links to the three-pillar culturally relevant pedagogy framework for culturally responsive pedagogy proposed by [Ladson-Billings \(2014\)](#). In other words, curriculums should center around three pillars: academic achievement, cultural competence, and critical consciousness. For local-culture–ELT integration, culture is a resource for learning and curriculum is an instrument for intercultural communicative competence ([Ontario Ministry of Education, 2013](#)). When local culture is explicitly embedded in course objectives, learning outcomes, and assessment tasks, students are more likely to value local culture. In contrast, exam-oriented systems and rigid syllabi often limit opportunities for meaningful cultural integration ([Ahmed et al., 2019](#); [Ghavamnia, 2020](#)). Within this context, curriculum design functions not only as a structural framework but also a key driver of how cultural content is positioned and experienced in language learning ([Matsuda & Watanabe, 2026](#)). An integrated approach to teaching culture and language is difficult to establish if language teachers lack training in cultural studies. However, in practice, teachers have been found lacking the pedagogical models to link subject matter with local traditions ([Kim & Sim, 2024](#)) and having fewer culturally relevant materials to engage students ([Darma et al., 2025](#)). In Mekong Delta, teachers have not adequately been trained in multicultural pedagogy and lack competencies in culturally responsive teaching, limiting their capacity to support linguistically and culturally diverse learners ([V. D. Nguyen et al., 2025](#)). Although they are ESL students, who have been trained for a long time at university for teaching in the future, they may not understand the value of intercultural communicative competence, and cultural

content is not always applied in classroom practice. These problems suggest that learning activities could move beyond the ESL four-wall classrooms to students' hometown through field trips, English language departments could bring experts of local cultures into the classroom to present culture, and teachers could be trained in-depth and allowed to tailor lessons to specific community contexts. For initial steps, teaching practices during university years bridge the gap between awareness and implementation (Chau & Truong, 2018). Teaching practice can also create skillful and high-quality English teachers in the future. ESL students should be trained to design, demo, and practice a *task-based* syllabus for integrating local culture in the ELT. The curriculum/syllabus should center around a three-pillar culturally relevant pedagogy framework for culturally responsive pedagogy theory. It has been found that good preparation through teaching practice during teacher education programs in university positively leads early-career teachers to self-efficacy and professional success as soon as they enter the profession (Abraham & Sickel, 2025). At the institutional level, effective integration of local culture requires clear curriculum planning, adequate facility provisioning, and localized pedagogical approaches aligned to students' backgrounds. These suggestions contribute to the successfulness of integrating local culture into English language teaching (Mede & Gunes, 2019).

Second, the importance of Facilities (X14) emphasizes an ongoing discrepancy between curriculum design and the realities of classroom practice (Ratri & Tyas, 2022) while also highlighting the need for stronger community–school partnerships. In sociocultural learning theory, facilities should go beyond desks and technology to how the physical and social environment mediates interaction and identity (Vygotsky, 1978). Physical facilities should be considered as learning zones or socially mediated environments where cognitive development and language learning occur (McLeod, 2025). Instead of serving as static containers, physical spaces function as a “third teacher” that influences how students interact, process information, and acquire language by encouraging collaboration, offering physical flexibility, and reducing overstimulation. If a facility is poorly designed, it limits the collaborative, dialogic spaces required for intercultural competence to develop intercultural communicative competence theory. Although teachers may recognize the value of local-culture integration, this understanding does not always translate into effective lessons when resources are limited. Weak community–school collaboration and/or partnership is a significant barrier (V. D. Nguyen et al., 2025; Duong et al., 2026) to integrating local culture and ESL in the Mekong Delta, hindering efforts to preserve intangible cultural heritage. The findings suggest internal and external proactive actions for the successful adoption of local-culture integrations in ELT. Internally, schools should place a strong emphasis on modern infrastructure, particularly multimedia tools and the internet (Government of Vietnam, 2022), which allows educators, students, and experts to present local cultural content in real instructional settings. In language education programs, these facilities play a crucial role in building both visual learning engagement and student confidence, which are essential for successful culture-based learning (Zhang, 2022). At the same time, the integration of culture into language teaching remains challenging when classrooms lack sufficient technological equipment, further reinforcing the need for facility-oriented investment (Castillo et al., 2025). Externally, local authorities and universities should collaborate to organize initiatives that promote and preserve local culture. These include joint exhibitions, festivals, guided tours of ethnic destinations, interactive tourist mobile applications, and culturally authentic games.

Third, the important factor Hometown (X1), in the intercultural communicative competence theory, states that hometown background is beyond a static demographic. Instead, it is the students' primary socialization and linguistic worldview (Oberste-Berghaus, 2024). It strongly influences students' attitudes and critical cultural awareness. This factor is also related to the core idea of Vygotsky's sociocultural learning theory. The local values,

beliefs, and customs shape how and what students learn through intellectual adaptation (McLeod, 2025). ESL students need to acquire linguistic knowledge but also sociocultural and strategic competences to effectively engage in intercultural interactions (Byram, 2020; Oberste-Berghaus, 2024). The statistical significance of the Hometown (X1) factor indicates that students' perceptions of integrating local culture into English language teaching are linked to their own socio-cultural environment. In the Mekong Delta, students' hometowns serve as a rich repository of indigenous wisdom and regional identity. This result aligns with Ratri et al. (2024), who argues that local culture integration is most effective when teachers use students' background knowledge and family experiences to help them feel closer to the culture. Furthermore, this empirical model validates Khasyar et al. (2025) theoretical framework, which points out that successful language pedagogy requires a harmonious bridge between school teaching and subjective factors such as hometown identity. The prominence of the Hometown factor demonstrates that local culture does not conflict with global English. Instead, students' hometown culture acts as a strong foundation that helps them connect with and communicate in a global environment.

This suggests several activities in ESL classrooms to bridge students' local identity and the English language's cultural norms for intercultural competence development. For example, students bring these distinct cultural backgrounds (i.e., Khmer, Cham, and Hoa (Chinese)) into the classroom. Teachers can encourage students to introduce 1–2 unique local customs and cultural elements such as costumes, folklore, traditional dances and music, food, handicraft, New Year activities, celebrations, etc., through intercultural interactions, discussions, collaborative projects, role-plays, or presentations. Teachers equip students with the necessary language knowledge and skills. These activities could offer practical guidance and modeling of real-life intercultural communicative acts and skills. They also assist in developing empathy and diverse cultural background knowledge. However, this novel teaching method raises several challenges, such as lack of facilities and resources, difficulties in designing cultural-based syllabus and materials, as well as calls for the need for in-depth teacher training (Darma et al., 2025).

Similar patterns have also been reported in northern Vietnam, where local culture integration enhanced students' intercultural awareness and learning motivation (T. H. M. Nguyen & Nguyen, 2022). Although the Red River Delta is generally characterized by a less culturally diverse environment than the Mekong Delta, students in both regions appear to value opportunities to connect English learning with their own cultural backgrounds. Challenges related to curriculum design and the limited availability of local cultural materials remain common across regions. Therefore, the prominence of Hometown (X1) suggests that local culture can function as an important foundation for both language learning and intercultural development.

Drawing on the three factors identified in this study—curriculum, facilities, and hometown—this study proposes a *task-based* syllabus of local-culture–ELT integration (i.e., regional cultural curricular) for ongoing syllabus adjustments, creating a holistic ecosystem that interconnects all three elements (Table 11). This *task-based* syllabus aims to integrate local culture in the current ELT syllabus and was piloted for the course Cross-Culture in the fourth-year bachelor's degree. The course descriptions and learning objectives are designed in accordance with Bloom's taxonomy, adapted from Byram (2020), and are integrated with Sustainable Development Goal (SDG) #4: Quality Education, especially Target 4.7 of UNESCO's 2030 Agenda (UNESCO, 2019; HESI, 2026) in terms of preserving intangible cultural heritage.

- Course description

Students will explore local culture practices of ethnic communities in the Mekong Delta such as Khmer, Cham, and Hoa (Chinese), especially indigenous or regional storytelling,

culinary arts, or traditional crafts (e.g., Cham poetry, Khmer silk weaving), festivals, etc. Students will critically analyze threats to these traditions and design educational campaigns to preserve them. In addition, students will be equipped and trained to have better skills and knowledge of presentation, cross-cultural concepts, globalization and identity, cross-cultural conflict and adjustments, verbal and nonverbal communication, personality and its social construction, and the values and roles of education in preserving intangible cultural heritage.

Table 11. A task-based syllabus of local-culture–ELT integration.

Boom's Level	Learning Outcomes/Objective (At the End of the Course, Students Would Be Able to ...)	Task-Based Activities	Locations of Learning
(1) Know	- Define and recall terms related to local cultural heritage - Know local customs and cultural elements such as costumes, folklore, traditional dances and music, food, handicraft, New Year activities, festivals, celebrations, etc. - Know cross-cultural concepts, globalization and identity, cross-cultural conflict and adjustments, verbal and nonverbal communication, personality and its social construction, and the values and roles of education in preserving intangible cultural heritage.	- Department/teachers bring experts of local cultures into the classroom to present local customs and cultures - Khmer, Cham, and Hoa (Chinese) students bring their distinct cultural backgrounds into the classroom - Teachers equip students with the necessary language knowledge and skills and knowledge of cross-cultural concepts, globalization and identity, cross-cultural conflict and adjustments, verbal and nonverbal communication, personality and its social construction, and the values and roles of education in preserving intangible cultural heritage	Classroom
(2) Understand	- Explore local culture practices - Explain the significance and history of local cultures	- Students explore and experience local culture practices in an authentic environment where the Khmer, Cham, and Hoa people live - Students are suggested to a 10-day homestay with local people in each place	Field trips/study at the local places (i.e., socially mediated environment)
(3) Apply	Apply language skills to summarize and present local folktales or practices	- Students write a summarized report and present what they have learned from their field trips, i.e., local traditional story, focusing on English and communication skills, such as stress, intonation, and emotional delivery - Students narrate a local traditional story (folktales retelling) in their own words	Classrooms
(4) Analyze	- Analyze the impact of globalization on preservation of local customs - Analyze how diverse cultural expressions and traditions are essential contributors to sustainable development	Small groups debate how modern technology and tourism impact the survival of indigenous languages or crafts and diverse cultural expressions and traditions are essential contributors to sustainable development	- Students learn independently - Classrooms
(5) Evaluate	Justify the importance of sustaining cultural heritage in education	- Students discuss and defend specific local practices that should be taught in schools to foster cultural diversity - Students deliver a talk about perseverations of local culture in the Mekong Delta region at a UNESCO/international conference	Classrooms
(6) Create	- Produce and present an original educational campaign for local cultural preservations - Create one product from local culture students experienced - Design a 2-day tour to explore Khmer, Cham, and Hoa communities' customs and cultures for international tourists - Design tour description or brochure of Khmer, Cham, and Hoa communities - Design and demo a local-culture–ELT integration syllabus in accordance with the current English textbooks in elementary/secondary/high schools (for students of the English Education major)	- Students deliver a 5-min TED-style talk proposing a school program, podcast, or festival designed to teach peers and/or students about their local heritages - Students suggest at least one method for local government to preserve local culture - Students introduce/show tour description or brochure of Khmer, Cham, and Hoa communities - Students use their designed 2-day tour to guide international tourists exploring Khmer, Cham, and Hoa communities' customs and cultures - Students demo the syllabus they designed at the local elementary/secondary/high schools (for students of the English Education major)	- Students learn independently - Classrooms - At the local places (i.e., socially mediated environment)

In short, the findings in this study call for consistent and practical actions in adoption of this integration internally and externally. At the institutional level, effective integration of local culture requires clear curriculum planning, adequate facility provisioning, and localized

pedagogical approaches aligned to students' backgrounds. Externally, local authorities and universities should collaborate to organize initiatives that promote and preserve local culture. Table 12 lists several practical suggestions for local-culture–ELT integration.

Table 12. Practical suggestions for local-culture–ELT integration.

Key Factors	Target Stakeholders	Practical Suggestions	Expected Outcomes
Curriculum	- Curriculum designers - Course coordinators	- Embed local culture (Mekong Delta heritage, local ethnic communities) explicitly into course objectives, learning outcomes, and assessment tasks - Train pre-service ESL students to design, demo, and practice a task-based syllabus integrated with current English textbooks for long-term impacts	Higher alignment between academic content and students' cultural background; enhanced learner engagement and professional self-efficacy; good preparations for expected ESL teachers for successful adoption of local-culture–ESL integration
Facilities	- University administrators, - Technicians - Local authorities - Local community/people - ESL teachers	- Invest in modern classroom infrastructure, particularly multimedia tools, and reliable internet access - Establish strong community–school partnerships to develop government-funded collaborative projects such as interactive tourist mobile applications, joint exhibitions/festivals, and culturally authentic games, etc., to guarantee accuracy and respect cultural heritage	- Modernized learning environments - Improved preservation of regional intangible cultural heritage - Government-funded collaborative projects and products between schools and local community (i.e., community-based tourism) such as interactive tourist mobile applications, joint exhibitions, culturally authentic games; tours to ethnical communities' destinations; 10-day field trips/homestays
Hometown (demographics and cultural background)	- ESL Instructors/lecturers - Students - Local authorities - Local community/people	- Extend learning activities beyond the traditional four-wall classrooms through field trips to students' hometowns - Encourage students to introduce local ethnic customs (Khmer, Cham, Hoa) via student-centered collaborative projects, role-plays, or presentations	Boosted student confidence and empathy; successful bridging of students' local identities with global English communication norms; 10-day field trips

6. Conclusions

6.1. Concluding Remarks

This research applied AI classification models to examine ESL students' views on integrating local culture into English teaching in the Mekong Delta. Among the tested models, the decision tree with oversampling achieved the best performance, which indicates strong reliability. The most influential factors were curriculum design, teaching facilities, and students' hometown. These findings highlight that both institutional planning and classroom implementation affect students' perceptions. Overall, this study provides clear evidence that curriculum reform should consider local cultural integration in a structured and systematic way.

6.2. Theoretical and Practical Contributions

This study makes both theoretical and practical contributions to the literature on local-culture integration in English language teaching (ELT) and AI-supported educational research. The findings strengthen learner-centered curriculum design in culturally diverse contexts by demonstrating that students' perceptions of local-culture integration are cooperatively shaped by curriculum structure, technological resources, and their sociocultural environments. The findings further support intercultural communicative competence theory, culturally responsive pedagogy, and sociocultural learning theory. They suggest that learning becomes more meaningful when new knowledge relates to students' cultural backgrounds, regional identities, and authentic social contexts. Overall, the findings high-

light that effective local-culture integration depends on the interaction among curriculum, facilities, and learners' sociocultural backgrounds.

From a methodological perspective, this study extends TESOL research by demonstrating the value of AI-based approaches for educational decision-making. The decision tree and support vector machine models effectively captured relationships among educational variables and identified the most influential predictors of students' perceived needs. They complement existing educational research methods by providing a data-driven approach to analyzing complex educational phenomena and informing evidence-based curriculum development. By integrating AI techniques with TESOL research, this study broadens methodological approaches available for investigating learners' perceptions and curriculum reform.

With reference to practical contributions, the findings provide clear guidance for curriculum planners, university leaders, and English language teachers. Since curriculum design and teaching facilities emerged as the strongest predictors, local culture should be systematically embedded into learning outcomes, course content, assessment, and daily classroom practice rather than being treated as teaching supplementary material (Niman, 2025). Universities should invest in culturally relevant learning resources, technological infrastructure, and sustained professional development that enables teachers to implement culturally responsive pedagogy effectively. Facilities should be viewed not merely as physical infrastructure but as learning environments that facilitate language acquisition, intercultural interaction, and collaboration between universities and local communities. Teachers are also encouraged to design localized learning activities that connect English language learning with students' hometown experiences and regional identities. Furthermore, the AI-based evidence generated in this study can assist universities in evaluating educational programs, identifying learners' needs, and supporting data-informed curriculum reform. To facilitate implementation, this study also develops a task-based syllabus that provides a practical model for integrating local culture into ELT while contributing to the preservation of the Mekong Delta's intangible cultural heritage and supporting the region's sustainable development.

6.3. Limitations and Avenues for Further Studies

This study should be interpreted considering several limitations related to research context and methodology. First, the data were collected from four public universities in the Mekong Delta, a region with specific sociocultural and educational characteristics. As a result, the findings may not be fully generalizable to other parts of Vietnam, such as the northern or central regions, or to universities in more urbanized areas where learning conditions, technological access, and exposure to intercultural environments may differ. Therefore, the results should be understood as context-specific or a pilot study rather than representative of all Vietnamese higher education settings.

Second, this study relied mainly on survey data, which may not fully capture students' deeper opinions, learning experiences, and classroom realities. While the quantitative approach allows for identifying general patterns, it may overlook deeper perspectives related to how local culture is taught and experienced in practice.

Third, there are several limitations of DT-based feature importance. Tree-based metrics are inherently biased toward high-cardinality and continuous features, which may have led to an overestimation of variables like *hometown* or *major*. Furthermore, since the algorithm relies on a greedy approach for node splitting, features selected at the root level often dominate the importance scores, potentially masking the contributions of other interacting features. These rankings reflect hierarchical decision rules rather than true independent effects. Finally, given a 32-variable dataset in our pilot study, the observed high predictive

accuracy is likely driven by multicollinearity among groups of variables. These initial insights are strictly exploratory and warrant further validation.

To address these limitations, future studies could adopt mixed-methods designs by combining quantitative data with qualitative approaches such as interviews, focus groups, or classroom observations. In addition, comparative studies across different regions of Vietnam would help to examine how context influences students' perceptions and validate the findings in diverse settings. Longitudinal research may also be useful to explore how students' perceptions develop over time. Additionally, applying a wider range of ML techniques and AI models and validating with alternative feature importance methods like random forest could compare, further improve prediction accuracy, and provide deeper insights into the factors influencing students' perceived needs. Future analyses should incorporate alternative methods, such as Permutation Feature Importance or SHAP (SHapley Additive exPlanations) values, which are known to provide more robust and consistent feature rankings across complex models. Finally, future studies should assess the model on independent, out-of-sample data to rigorously evaluate its generalizability. Future works could also implement rigorous feature selection techniques, such as correlation and recursive feature elimination (RFE) to reduce dimensionality, minimize redundancy, and identify the most stable feature subsets.

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