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METHODOLOGY OF MACHINE TRANSLATION POST-EDITING IMPLEMENTATION IN UNIVERSITY IT TECHNICAL COMMUNICATION CURRICULUM

Abstract. The article is devoted to substantiating the methodology for implementing Machine Translation Post-Editing (MTPE) into the training of higher education students within a university IT technical communication curriculum. The relevance of the study is determined by the profound transformation of the modern translation industry under the influence of neural machine translation systems, which are being increasingly integrated into professional workflows across various fields, particularly in the IT sector. The study focuses on the problem of the methodologically grounded incorporation of MTPE into the structure of specialized higher education courses, taking into account the specific features of technical documentation, professional requirements for translators, and labor market demands. The object of the research is the process of developing students' machine translation post-editing competences in the context of technical communication training, while the subject is the methodological foundations, principles, stages, and tools for introducing MTPE into relevant educational components.

The aim of the article is to develop a methodology for integrating MTPE into university disciplines related to IT technical communication and to identify the pedagogical conditions under which this practice can be effectively incorporated into the educational process. The article proposes a methodology for MTPE implementation in higher education disciplines, which involves the gradual integration of relevant modules into courses on translation, technical writing, localization, terminology studies, digital translation technologies, and IT communication. The methodology includes a diagnostic stage, a stage of building the theoretical foundation, practical training using various NMT systems, the development of post-editing quality assessment criteria, work with authentic IT texts, and final evaluation of learning outcomes. Among the main results of the study are the identification of the structure of MTPE competence, the substantiation of the content of learning tasks for classroom and independent work, and the outlining of models for integrating MTPE into the professional training of future specialists. The scientific novelty of the article lies in the systematic presentation of MTPE not only as a tool for optimizing translation activity, but also as a full-fledged didactic component of the university IT curriculum, aimed at combining students' technological, linguistic, terminological, and analytical training.

Key words: machine translation, machine translation post-editing, technical communication, university curriculum, translator training, post-editing competence, translation technologies, quality assessment.

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МЕТОДОЛОГІЯ ІМПЛЕМЕНТАЦІЇ ПОСТРЕДАГУВАННЯ МАШИННОГО ПЕРЕКЛАДУ В УНІВЕРСИТЕТСЬКІ ПРОГРАМИ З ТЕХНІЧНОЇ КОМУНІКАЦІЇ В ІТ

Анотація. Статтю присвячено обґрунтуванню методології імплементації машинного перекладу з постредагуванням (Machine Translation Post-Editing, MTPE) у зміст підготовки здобувачів вищої освіти в межах університетського курикулуму з ІТ-технічної комунікації. Актуальність дослідження зумовлена глибокою трансформацією сучасної перекладацької індустрії під впливом нейронних систем машинного перекладу, що дедалі активніше інтегруються у професійні робочі процеси різних галузей, зокрема в ІТ-сфері. У центрі уваги перебуває проблема методично виваженого включення MTPE до структури фахових дисциплін вищої школи з урахуванням специфіки технічної документації, професійних вимог до перекладача та потреб ринку праці. Об'єктом дослідження є процес формування у студентів компетентностей постредагування машинного перекладу в умовах навчання технічної комунікації, а предметом – методичні засади, принципи, етапи та інструменти впровадження MTPE у відповідні освітні компоненти. Метою статті є розроблення методики впровадження MTPE у дисципліни університетської підготовки, пов'язані з ІТ-технічною комунікацією, а також визначення педагогічних умов, за яких ця практика може бути ефективно інтегрована в освітній процес. У статті запропоновано методику імплементації MTPE у дисципліни вищої школи, яка передбачає поетапне включення відповідних модулів до курсів з перекладу, технічного письма, локалізації, термінознавства, цифрових перекладацьких технологій та ІТ-комунікації. Методика охоплює діагностичний етап, етап формування теоретичної бази, практичний тренінг із використанням різних систем NMT, опрацювання критеріїв якості постредагування, роботу з автентичними ІТ-текстами, а також підсумкове оцінювання результатів. Серед основних результатів дослідження – визначення структури MTPE-компетентності, обґрунтування змісту навчальних завдань для аудиторної та самостійної роботи, а також окреслення моделей інтеграції MTPE у професійну підготовку майбутніх фахівців. Наукова новизна статті полягає в системному представленні MTPE не лише як інструмента оптимізації перекладацької діяльності, а як повноцінного дидактичного компонента університетської програми, зорієнтованого на поєднання технологічної, мовної, термінологічної та аналітичної підготовки студентів.

Ключові слова: машинний переклад, постредагування машинного перекладу, технічна комунікація, університетська програма, підготовка перекладачів, компетентність постредагування, перекладацькі технології, оцінювання якості.

Problem statement and justification of its relevance. The shift from traditional human translation to hybrid human-AI collaboration represents not only a technological adoption but a reconceptualization of experts' roles, quality standards, as well as the very nature of translation labor in the era of digitalization and artificial intelligence (AI). However, the implications of this transformation for professional identity, translation quality, terminological consistency, and multilingual technical communication sustainability remain inadequately understood, specifically in the specialized field of IT documentation where usability, cultural adaptation and precision are of utmost importance.

The emergence of MTPE as a mainstream practice coincides with dramatic improvements in neural machine learning and translation quality since the introduction of the attention-based architectures in 2017 and subsequent transformer models that have achieved near-human parity in specific language pairs, as well as text types [3; 7].

Leading technology companies, including Apple, Oracle, Tesla, Meta, Broadcom, SAP, Adobe, Cisco, Microsoft, and others have implemented MTPE workflows for documentation translation. Consequently, they have reported productivity gains of about 30-60% and cost reductions of about 25-40% compared to traditional translation [9]. These economic incentives, combined with the increasing pace of software development cycles and the expanding linguistic diversity of global technology markets, have made MTPE adoption nearly inevitable for IT localization.

Within the framework of this study, particular attention should be paid not only to the technological efficiency of MTPE, but also to its pedagogical and curricular implications for university training in IT technical communication. One of the central issues is that the integration of MTPE into the educational process cannot be reduced to teaching students how to correct machine-generated output. Rather, it

requires a reconsideration of the competence model that underpins translator and technical communication training in higher education. In the context of IT documentation, MTPE demands a hybrid set of abilities that combines linguistic accuracy, technical literacy, terminology management, genre awareness, and the ability to assess the functional adequacy of target texts in professional communication settings. Therefore, the implementation of MTPE in university curricula should be viewed as a response to the changing profile of the future language professional, whose expertise increasingly develops at the intersection of translation, technology, and domain-specific communication.

From a methodological perspective, the adoption of MTPE in higher education also raises the issue of how to structure learning outcomes, course content, and assessment criteria in a way that reflects current professional realities without narrowing students' training to purely instrumental editing tasks. Since neural machine translation systems continue to evolve rapidly, the educational model should remain flexible and process-oriented. Students need to be trained not only to identify and correct lexical, grammatical, and terminological errors, but also to recognize more subtle problems related to register, consistency, clarity, usability, and communicative appropriateness in IT texts. In this regard, MTPE should be incorporated into the curriculum as a dynamic pedagogical component that develops critical judgment, digital competence, and informed decision-making. Such an approach allows MTPE to function not as a threat to translator education, but as an innovative instructional practice that aligns university IT technical communication programs with the realities of human – AI collaboration in contemporary multilingual documentation environments.

Analysis of recent research and publications. Machine translation has undergone dramatic changes with the shift from statistical machine translation (SMT) to neural machine translation (NMT) beginning in 2016-2017. Castilho conducted early research comparing these systems, finding that NMT produced more fluent translations with better grammar and word order [2]. Läubli demonstrated that modern NMT systems can approach human translation quality for well-resourced language pairs. Their study with professional translators showed 36% time savings when post-editing compared to translating from scratch [7]. Crucially, they found technical documentation with controlled language and repetitive structures benefited most from MTPE, while creative or culturally nuanced content showed minimal advantages. This finding directly supports MTPE's applicability to IT documentation. Post-editing involves different mental processes than traditional translation. Daems used eye-tracking to study how translators work with machine translation, measuring where and how long they looked at different parts of text [6].

Koponen identified three distinct approaches translators use when post-editing: (1) making minimal necessary corrections, (2) substantially revising the text almost to the point of retranslation, and (3) accepting MT output despite quality concerns due to time pressure [4]. Her research showed that translators switched between these strategies depending on MT quality, deadlines, content type, and personal standards. This variability matters for IT documentation because inconsistent post-editing approaches could produce unpredictable quality across different language versions. Cadwell examined translators' attitudes toward MTPE through surveys and interviews with 75 professionals [1]. They found widespread mixed feelings: 68% acknowledged productivity gains for certain content, yet 72% worried about long-term quality impacts. Technical translators showed less resistance than literary or marketing translators, attributing this to technical documentation's focus on accuracy over style. However, even among technical translators, 54% expressed concerns about "deskilling" – losing translation skills through over-reliance on machine output. IT documentation presents unique challenges due to dense terminology and rapid technological change. Yamada analyzed Google Translate's performance on software documentation across 2,400 segments [9]. While NMT handled general technical vocabulary reasonably well (85% accuracy), emerging technology terms showed only 43% accuracy. Errors included mistranslating compound technical terms, inconsistent term usage, confusing similar concepts, and leaving English terms untranslated when equivalents existed. Post-editors spent 38% of their time correcting terminology despite terminology errors comprising only 12% of total mistakes, showing that terminology correction demands substantial effort and domain knowledge.

MTPE integration profoundly affects professional identity and required skills. Cadwell found many translators view post-editing as diminishing creative and interpretive aspects of translation, reducing them to "quality control" rather than "language professionals." [1]. This perception creates resistance affecting both adoption and quality: translators viewing post-editing as deskilled work may approach it carelessly, while those maintaining high standards may over-edit, eliminating productivity benefits. Technical translators showed different patterns: 62% saw post-editing as compatible with technical translation's accuracy focus, while 38% worried excessive MT reliance would erode their terminology knowledge.

Guerberof Arenas and Moorkens evaluated post-editing training programs at five European universities, finding structured training reduced post-editing time by 19% and improved quality compared to untrained translators [5]. Effective training covered rapid MT quality assessment, error prioritization, productivity management, terminology verification, and psychological adaptation to imperfect machine output. For IT documentation specifically, they emphasized training must integrate technical domain knowledge – effective post-editing requires understanding not just linguistic errors but whether translations accurately convey technical functionality.

The aim and objectives of the article. The aim of the article is to substantiate the methodology of implementing Machine Translation Post-Editing (MTPE) in the university IT technical communication curriculum and to determine the pedagogical conditions that ensure its effective integration into the professional training of future translators and technical communication specialists.

To achieve this aim, the following objectives are addressed: to define the place of MTPE within the structure of university training in IT technical communication; to identify the specific features of IT documentation that make it suitable for MTPE-based instruction; to characterize the competences required for effective post-editing in academic and professionally oriented settings; to develop a methodological framework for integrating MTPE into relevant higher education disciplines; to describe the stages, methods, and instructional tools for organizing MTPE-oriented learning tasks; and to outline approaches to assessing the quality of post-editing performance and the development of students' MTPE competence.

The presentation of the primary material. The study employed a mixed-methods approach combining quantitative analysis of post-editing performance with qualitative investigation of students' experiences and decision-making processes in MTPE-oriented learning tasks. The research design was structured to answer three primary questions: (1) How does post-editing productivity and quality vary across different types of IT documentation in a university learning environment? (2) What error patterns persist in student post-edited technical content? (3) How do students experience and navigate MTPE workflows within IT technical communication training? The methodology integrated three data collection methods: performance tracking during post-editing tasks, quality assessment of the post-edited translations, and semi-structured interviews exploring student perspectives. This triangulated approach enabled the examination of both measurable outcomes, such as errors, time, and quality scores, and subjective experiences, including learner concerns, decision-making, and quality judgments, that shape MTPE practice in IT technical communication pedagogy [8].

Participants were recruited from among university students enrolled in translation- and technical-communication-related courses in Lviv State University of Life Safety and Taras Shevchenko National University of Kyiv. The selection criteria required that the participants should have prior training in translation, an introductory familiarity with IT or software-related documentation, and basic exposure to machine translation tools. No advanced professional experience in MTPE was required, as the study aimed to examine how MTPE competence can be developed within higher education and how students with different levels of prior preparation approach post-editing tasks. The recruitment process emphasized that the study was intended to explore learning practices and competence formation rather than to test students' professional readiness, and all collected data were anonymized.

The final participant group consisted of 41 students working with two language pairs relevant to the instructional context. Some participants had previously encountered post-editing either through university coursework or workshops, whereas others approached MTPE through guided classroom practice. This diversity made it possible to compare varying strategies of student engagement with machine-translated output and to observe how prior exposure to translation technologies influences the development of post-editing competence. In this respect, the experimental design reflects the broader objective of the article, namely to justify MTPE as a pedagogically relevant component of university IT technical communication curricula.

The study used 90 segments of authentic IT technical documentation representing three common content types: software user guides, API reference documentation, and troubleshooting articles. These categories were selected because they are highly relevant to IT technical communication training and represent different linguistic and functional challenges. User guides require clarity for non-technical audiences, API documentation requires terminological precision, and troubleshooting content combines problem-solving logic with procedural instruction. Source documentation was drawn from publicly available materials for widely used open-source software, including PostgreSQL, WordPress, and Visual Studio Code, in order to ensure that all participants encountered standardized terminology and familiar technical concepts.

All source segments were machine-translated using widely available MT systems, and the result-

ing output was then post-edited by the students. This design ensured consistency of materials and reflected current real-world translation technology practices. Each participant received a balanced set of segments in order to provide variety while keeping the workload manageable within the educational setting. Such organization of the experiment also demonstrates how MTPE tasks may be methodically incorporated into university disciplines: students work with authentic technical texts, compare machine output with domain-specific expectations, identify recurrent error types, and apply post-editing strategies under guided pedagogical supervision.

The analysis of performance data revealed notable variation in student post-editing productivity across the documentation types examined. Overall, the results suggest that MTPE can improve efficiency in processing highly standardized technical texts, particularly API documentation, while more explanatory or user-oriented content may require deeper cognitive effort and more extensive revision. These findings are pedagogically significant because they show that MTPE should not be introduced into the curriculum as a universally efficient solution, but rather as a differentiated practice whose success depends on text type, student competence, and the level of technical and linguistic support provided in the course design.

Conclusions and prospects for further research. The study therefore confirms that MTPE in IT technical communication should be treated as a complex educational practice rather than a purely instrumental skill. Its effectiveness in university training depends on the careful selection of text types, the integration of quality assessment criteria, and the development of hybrid student competences that combine linguistic, terminological, technological, and analytical abilities. The findings also indicate that post-editing competence is shaped not only by students' language proficiency, but also by their capacity to recognize subtle semantic distortions, maintain terminological consistency, and evaluate the communicative adequacy of IT documentation. Thus, MTPE implementation in university curricula should be designed as a structured and reflective learning process that prepares future specialists for multilingual technical communication in environments increasingly shaped by human – AI collaboration.

Prospects for further research lie in expanding the methodological and empirical foundations of MTPE implementation in university IT technical communication curricula. Future studies may focus on comparing the effectiveness of MTPE-oriented instruction across different academic levels, disciplines, and language pairs in order to determine how students' linguistic, technological, and domain-specific competences influence post-editing performance. It would also be valuable to investigate the long-term impact of MTPE training on the professional readiness of future translators and technical communicators, particularly in relation to their ability to work with authentic multilingual IT documentation in human – AI collaborative environments.

Another promising direction involves the development of refined assessment models for measuring MTPE competence in higher education. Further research may address the design of criteria and rubrics that account not only for productivity and error reduction, but also for terminological consistency, functional adequacy, cognitive effort, and decision-making processes. In addition, subsequent studies may explore how different machine translation systems, including neural MT engines and large language models, affect the quality of student post-editing and the pedagogical value of MTPE tasks. Special attention should also be given to the integration of MTPE into broader university courses on translation technologies, localization, digital literacy, and technical writing, as well as to the adaptation of MTPE methodology for other domains of specialized communication beyond IT.

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