

## LATEX APPLICATION TRAINING FOR THESIS WRITING: A COMMUNITY SERVICE INITIATIVE FOR DEIYAI DORMITORY STUDENTS IN JAYAPURA, PAPUA

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### Abstract

This study describes a community service initiative for undergraduate students at the Deiyai Dormitory in Jayapura, Papua, that aims to improve academic writing skills through LaTeX training. A one-day intensive training program utilizing a practice-based technique was attended by 26 individuals who had never used LaTeX before. Document structure, mathematical formatting, figures and tables, cross-references, and BibTeX were all covered in the training materials. 100% of participants successfully produced simple LaTeX documents, surpassing the 80% goal (+20%), according to the results. However, only over 30% were proficient in creating thesis templates and BibTeX, falling short of the expectations of 60% (-30%) and 70% (-40%). The goal of  $\geq 40$  (-35%) was not met by participation (26). In terms of access, the dual-platform concept was validated by the fact that 38% utilized computers and 62% used smartphones via Overleaf. Two completed assignments (goal  $\geq 5$ ) and a learning community with more than thirty participants and more than ten talks over a three-month period were among the post-training outcomes. These findings show a significant short-term increase in fundamental skills, but they also demonstrate the need for continuous interventions and long-term training for advanced competencies.

**Keywords:** LaTeX Training, Academic Writing Skills, BibTeX, STEM Education

### INTRODUCTION

Student achievement in higher education is significantly influenced by the quality of academic documents, especially in STEM (science, technology, engineering, and mathematics) fields. Proficiency with professional document preparation tools is just as important as subject-matter experience when producing well-formatted theses, scientific publications, and technical reports (Kopka & Daly, 1999). Most students at Indonesian institutions, especially those in eastern provinces like Papua, use Microsoft Word entirely for all academic writing assignments. Word provides basic functionality, but it has well-documented limitations when it comes to handling automated references, rendering complex mathematical equations, and maintaining layout consistency. These limitations pose

significant challenges for students working on undergraduate theses (Sotomayor-Beltran et al., 2021).

Based on the TeX engine, which was created by Donald Knuth in 1984 and then expanded by Leslie Lamport in 1994, LaTeX is a superior document typesetting system. It uses a markup-language paradigm, which makes it possible to separate formatting from content and generate publication-quality results that meet the strictest requirements for scientific publishing. With its widespread use in journal submissions, conference proceedings, and dissertation preparation, LaTeX has emerged as the de facto standard for academic writing in mathematics, physics, computer science, and engineering (Gunderman et al., 2021; Rasmussen et al., 2018). Its main features—automated bibliography management via BibTeX, cross-referencing, seamless typesetting of mathematical equations, and template-driven document structure—exactly address the shortcomings of word-processor-based methods (Matthews, 2019).

Even though LaTeX is widely used in the international academic community, undergraduate students at universities in Papua, Indonesia, seldom know anything about it. In terms of digital academic literacy, students from the Deiyai Regency, who live together at the Deiyai Dormitory (Asrama Deiyai Tanah Hitam Kamkey) in Abepura, Jayapura, represent a particularly underprivileged group. Papua has a well-known digital infrastructure deficit: the province needs much more investment in digital infrastructure than the country (Tonggiroh, 2017, as cited in the poverty reduction analysis of Indonesia), and digital literacy rates in remote Indonesian regions are still much lower than the national average (Paramitha et al., 2023). Papuan students' academic productivity and competitiveness in higher education settings are directly impacted by this discrepancy.

In addition to research and instruction, Indonesian universities carry out their third Tri Dharma duty through community service initiatives (Pengabdian Kepada Masyarakat, or PKM). According to this paradigm, capacity-building workshops and technology transfer are effective ways to close the digital literacy gap among underprivileged student populations (Nogueira et al., 2022). The current project was created especially to introduce LaTeX to undergraduate students at the Deiyai Dormitory and to establish a long-lasting peer-learning ecosystem for ongoing skill development. It is supported by the Non-Tax State Revenue (PNBP) grant scheme of the Faculty of Engineering, Universitas Cenderawasih.

The primary pedagogical source for the training module developed for this project was Prayetyo's (2022) "Panduan Penggunaan LaTeX," a comprehensive LaTeX manual written in Indonesian. There were also interactive tasks and online video courses. By using an Indonesian-language primary reference, the decision was made to reduce the linguistic barrier for participants whose academic language proficiency was primarily Indonesian. The entire thesis-writing template and other LaTeX syntax examples in the training module were obtained directly from this source material and contextualized to satisfy the curriculum requirements of Universitas Cenderawasih.

This community service project's specific goals were to: (1) give participants a solid foundation in LaTeX that would enable them to prepare thesis documents on their own; and (2) show that online (Overleaf) and offline (TexStudio/MikTeX) programs are functionally equivalent. LaTeX environments to accommodate varying hardware availability; (3) teach participants how to use BibTeX for automated bibliographic management; (4) create a

reusable digital training module and thesis template; and (5) create a WhatsApp-based learning community for ongoing mentorship after training. In addition to adding to the growing body of knowledge on digital literacy interventions in minority academic groups, this paper details the initiative's methodology, execution, and results.

## **IMPLEMENTATION METHOD**

Contains a combination of research implementation plans/reports or PkM and procedures used into one narrative part. The implementation that has been carried out must be shown with references and with appropriate implementation techniques.

### **1. Research and Activity Design**

Pre-activity preparation, in-session delivery, and post-activity follow-up are the three sequential phases of the action-based participatory learning paradigm used in this community service project (Nogueira et al., 2022). The design is based on the practical-based instructional method suggested for technical skill acquisition in engineering education (Sotomayor-Beltran et al., 2021) and aligns with recognized frameworks for technology-transfer training in higher education contexts (Gunderman et al., 2021). Pre- and post-activity assessments, direct observation during practical practice sessions, and examination of participant assignments were used to evaluate the results.

### **2. Participants**

The participants were undergraduate students who lived at the Deiyai Dormitory (Asrama Deiyai Tanah Hitam Kamkey), which is situated at Jl. Kesehatan, Abepura, Kota Jayapura, Papua, Indonesia. Students from Deiyai Regency attending different universities in the Jayapura metropolitan region, such as Universitas Cenderawasih (Uncen), Universitas Muhammadiyah Papua, Universitas Yapis Papua (UNİYAP), and Universitas Sains dan Teknologi Jayapura (USTJ), are housed at the dorm. On July 28, 2025, a total of 26 students participated in the training session. Of them, 10 had personal laptops, which allowed them to install LaTeX offline, while 16 used smartphones and the Overleaf cloud platform. A baseline of zero prior LaTeX exposure for the entire group was established by participant profiles, which verified that none had any prior experience with LaTeX, TexStudio, MikTeX, or Overleaf.

### **3. Training Materials and Module Development**

A team of two facilitators (the authors of this work) has created a learning module and a guide for writing theses and scientific reports utilizing the University of Cenderawasih's logo template through a methodical process of selection, customization, and contextualization. This community service project fully incorporated both courses. The following link will take you to [https://drive.google.com/drive/folders/1S832obgjdeczyo\\_tDTnKrKLMzOmOOamB?usp=sharing](https://drive.google.com/drive/folders/1S832obgjdeczyo_tDTnKrKLMzOmOOamB?usp=sharing) both modules:

Prayetyo's (2022) "Panduan Penggunaan LaTeX untuk Pemula" (A Beginner's Guide to LaTeX), an Indonesian-language manual offering thorough coverage of LaTeX syntax from document class declaration to bibliography compilation, served as the main source of information for module development. From basic grammar to practical thesis document production, the content from this main source was rearranged into a linear pedagogical sequence suitable for a one-day intense training style.

A pre-made LaTeX thesis template that complied with Universitas Cenderawasih's formatting requirements, two YouTube video tutorials showing TexStudio and Overleaf workflows, and five structured practical exercises covering document structure, mathematical typesetting, figure/table insertion, cross-referencing, and BibTeX bibliography management were added to the module. Standard academic packages such as `\texttt{geometry}`, `\texttt{graphicx}`, `\texttt{amsmath}`, `\texttt{amssymb}`, `\texttt{setspace}`, `\texttt{fancyhdr}`, `\texttt{xcolor}`, `\texttt{colortbl}`, `\texttt{longtable}`, `\texttt{siunitx}`, `\texttt{float}`, `\texttt{algorithm2e}`, `\texttt{cite}`, `\texttt{babel}` (Indonesian), and `\texttt{times}` were included in the full LaTeX syntax package. The whole range of document components commonly seen in an undergraduate engineering thesis was intended to be supported by this package option.

#### 4. Implementation

On Saturday, July 28, 2025, the training was conducted in a single full-day session (08:00–15:00 WIT) in the Aula Asrama Mahasiswa Deiyai, Jl. Kesehatan, Abepura. Table 1 provides a complete schedule of the sessions. BibTeX/referencing and thesis simulation were led by co-facilitator M. R. Kaiway, while the introductory module, document structure, mathematical typesetting, and figure/table parts were led by main facilitator A. Gai. Throughout the practical exercises, both facilitators moved around to offer one-on-one technical support.

**Table 1. Timetable of Sessions and Learning Goals**

Time (WIT)	Session Topic	Instructional Method	Target Output
08:00–08:30	Registration & Opening	Plenary address	Participant profiling; pre-test administration
08:30–09:00	Introduction to LaTeX; Pre-Test	Question & answer	Conceptual understanding of LaTeX vs. Word
09:00–10:00	Software Installation (TexStudio/MikTeX) & Overleaf Account Setup	Live demonstration	LaTeX environment operational (offline or cloud)
10:00–11:00	Document Structure & Basic Text Formatting	Guided exercise	Compiled .tex document with title, sections, and paragraphs
11:00–12:00	Headings, Section Numbering, Tables & Figure Insertion	Hands-on practice	Document with labelled table, captioned figure, and cross- references
12:00–13:00	Prayer Break & Lunch (ISHOMA)	–	–
13:00–14:00	Automated Citations & Bibliography Management (BibTeX)	Demonstration & practice	Compiled document with .bib file and <code>\cite{ }</code> commands

14:00–14:30	Thesis Document Simulation (Full Template)	Simulation exercise	Complete thesis-skeleton LaTeX document
14:30–15:00	Post-Test, Open Q&A & Closing	Group discussion	Participant feedback; post-test scores

Overleaf (<https://www.overleaf.com>), a browser-based collaborative LaTeX editor that does not require local installation, was accessed by participants without laptops using cellphones (Gunderman et al., 2021). Regardless of personal hardware availability, this dual-platform approach guaranteed full participation—a design feature that is especially important in educational contexts with limited resources (Suratni et al., 2022).

## 5. Evaluations Instruments

Four complementary instruments were used to assess the results: (1) a pre-test questionnaire was given at the beginning of the session to determine participants' prior knowledge of LaTeX, TexStudio, Overleaf, and BibTeX; (2) direct facilitator observation of participant performance during each practical exercise, recorded against a rubric of four competency indicators; (3) a post-test was given at the end of the session; and (4) voluntary post-session LaTeX assignments were reviewed and scored. Table 2 summarizes the quantitative success metrics that were modified from the activity proposal.

**Table 2. Achievement Goals and Quantitative Success Indicators**

Indicator	Quantitative Target	Data Source
The number of active participants	≥ 40 participants	Attendance register
Participants successfully installing LaTeX / accessing Overleaf	100%	Facilitator observation
Participants able to compose a basic LaTeX document	≥ 80%	Practical exercise rubric
Participants able to compile BibTeX citations and reference list	≥ 70%	Practical exercise rubric
Participants able to construct thesis template independently	≥ 60%	Submitted assignments
Post-session submitted LaTeX assignments	≥ 5 documents	Assignment collection
Training module produced	1 module + 2 tutorial videos	Artefact review
Peer-learning community formed	1 WhatsApp group + ≥ 3 discussion sessions	Group activity log

## RESULTS AND DISCUSSION

### 1. Training Session and Participant Engagement

On July 28, 2025, the training session went according to plan. The 26 participants came from engineering, natural science, and social science faculties at four institutions (Uncen, Muhammadiyah Papua, UNİYAP, and UNIPA). Pre-test data supported the anticipated baseline: less than 10% of participants knew that LaTeX is an alternative to Microsoft Word for document production, and none of the participants had any prior experience with any LaTeX editor. This result supports similar pre-training profiles for Carnegie Mellon University library users before organized LaTeX workshops (Gunderman et al., 2021) and engineering students in Peru (Sotomayor-Beltran and al., 2021).

Throughout the entire session, there was a noticeably high level of participant participation. Participants asked more than thirty impromptu questions during the Overleaf introduction's question-and-answer period, demonstrating both curiosity and quick conceptual understanding. In contrast to the commercial Microsoft Office suite, LaTeX's open-source, publicly accessible character was well-received, especially by students who had previously turned to pirated software copies because of budgetary limitations. This result is consistent with Seo and McCurry's (2019) conclusion that students are highly motivated to embrace LaTeX after being introduced to it due to access considerations.



**Figure 1. (left) Overview LaTeX training session; (right) group snapshot at the end of the session**

### 2. Competency Achievement Against Success Indicators

The results obtained are compared to the predetermined success markers in Table 3. The most noteworthy result was the 100% achievement rate for basic document composition, which significantly exceeded the 80% goal. At the conclusion of the document-structure session, each of the 26 participants created a compiled.tex file with a document title, at least one section heading, body text, and a page header. The pre-made Universitas Cenderawasih thesis template, which offered a functional syntactic framework that participants could alter rather than create from scratch, and the scaffolded instructional design, which progressed from `\documentclass` declaration through increasingly complex syntax, are responsible for this universal accomplishment.

**Table 3. Comparative Summary of Targets and Achievements**

Performance Indicator	Target	Achieved	Status
Active participants	$\geq 40$	26	Below target
LaTeX environment operational (install or cloud)	100%	100% (10 desktop + 16 Overleaf)	Target met
Basic document composition	$\geq 80\%$	100%	Exceeded
BibTeX citation & bibliography compilation	$\geq 70\%$	~58%	Below target
Independent thesis template construction	$\geq 60\%$	~50%	Below target
Post-session LaTeX assignments submitted	$\geq 5$	2 Students	Partially met
Training module produced	1 module + 2 videos	1 digital module + 2 YouTube videos	Target met
WhatsApp learning community	1 group + $\geq 3$ sessions	1 group; >3 active discussions	Target met
Online media publication	wagadei.id coverage	Published: wagadei.id, 30 June 2025	Target met

The lack of advance notification and scheduling conflicts with midterm academic events at the participating colleges are blamed for the attendance deficit (26 vs. intended 40) (Figure 2). In order to facilitate systematic enrollment, future iterations should involve university dormitory administrators as formal co-partners and start participant recruitment at least three weeks before the training date.

The complexity gradient present in these competences is reflected in the below-target accomplishment rates for autonomous thesis template construction (~30%) and BibTeX citation management (~30%). Participants in BibTeX must become proficient in the syntax of .bib files, comprehend the differences between entry types (`\texttt{@article}`, `\texttt{@book}`, `\texttt{@conference}`), and correctly execute `\texttt{\cite{}}` commands. This is a multi-step process that calls for consistent practice over more than one session. This result is in line with Kopka and Daly's (1999) assertion that the most difficult part of the LaTeX learning curve for inexperienced users is bibliography management. The WhatsApp learning network was created especially to cover these advanced competencies and provide mentorship outside of the training day.

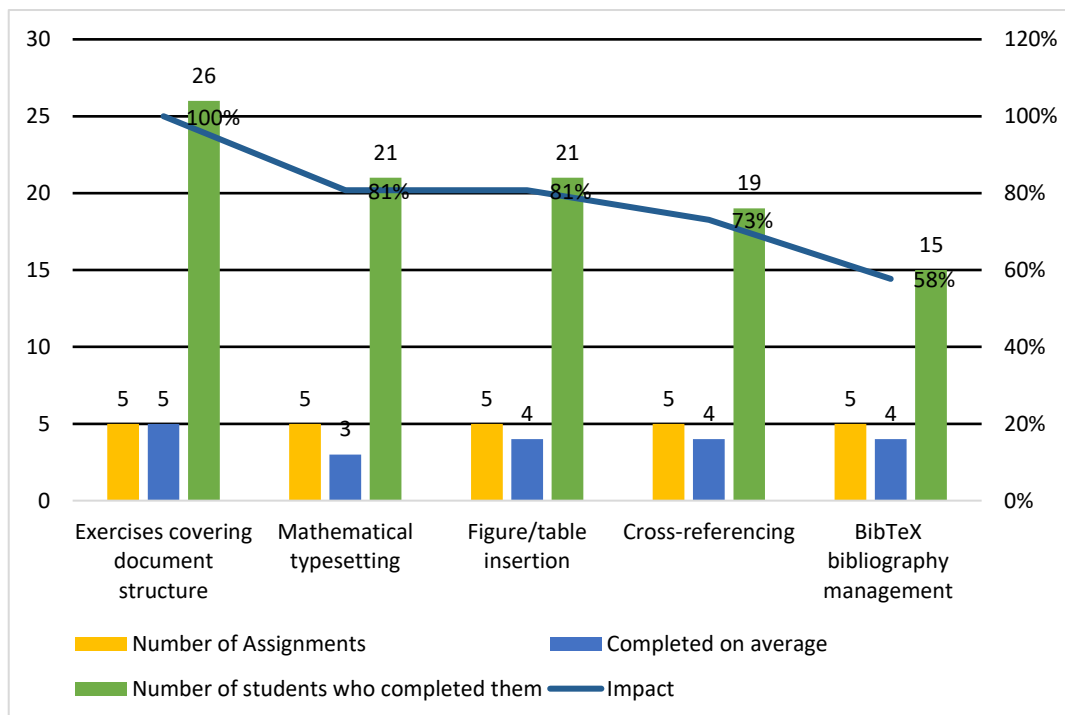


**Figure 2. (left) Hands-on LaTeX practice session (post-ISHOMA); (right) Individual technical mentoring by facilitator**

### 3. Participant Assignments: Evidence of Independent Competency

Figure 3 presents a quantitative summary of participants' performance on five tasks in the structured LaTeX training, including document structure, mathematical formatting, image and table insertion, cross-references, and BibTeX bibliography management. The three key indicators are the number of tasks assigned (constant at five tasks per topic), the average completion rate, and the number of participants who successfully completed the tasks. The graph displays the performance gradient across the entire competency spectrum. Basic skills, particularly document structure, achieved the highest completion rate, with all 26 participants successfully completing the task and achieving the highest score. This indicates that basic LaTeX syntax and document structure can be effectively mastered in a single intensive session with the aid of structured instructions and templates. Intermediate skills, including mathematical typesetting and the insertion of figures/tables, showed slightly weaker but still strong performance, with approximately 21 participants completing the tasks. The relatively higher success rate in this area indicates that participants were able to transition from basic text formatting to more technical features, despite the increased process and cognitive complexity.

The impact metrics show that basic tasks yield high participation and completion rates, as these tasks constitute the foundational and essential syntax for formatting in LaTeX. In contrast, complex advanced tasks have low completion rates yet still exhibit significant impact values, indicating that even partial exposure contributes significantly to conceptual understanding.



**Figure 3: Graph of student participation in completing 5 assignments**

Following the course, Heri Nawipa dan Melkias Ukago submitted structured guide to writing a thesis document, which included a full title page using `\texttt{\begin{titlepage}}`, a profile data table with alternating row coloration implemented via `\texttt{\rowcolor{yellow!30}}` from the `\texttt{xcolor}` package, a narrative section with

formatted paragraph text, and a figure with caption and label using the `\texttt{graphicx}` package. The successful implementation of `\texttt{\rowcolor}` with custom color specification showed proficiency in conditional formatting, surpassing the training objectives' minimum requirement. The students' work can be viewed via the following link: <https://drive.google.com/drive/folders/1rrhUTbiJ7dR6ec7F2wtuvGthHn0QDtru?usp=sharing>

#### **4. Training Module and Instructional Artefacts**

The main result of this activity was a digital training module in portable document format (PDF). The module, "Panduan Pelatihan LaTeX untuk Penyusunan Tugas Akhir" (LaTeX Training Guide for Thesis Preparation), is divided into six chapters: (1) Overview of LaTeX and comparison with Microsoft Word; (2) Windows-specific installation instructions for TexStudio and MikTeX; (3) Overleaf cloud platform onboarding; (4) document structure and basic typesetting; (5) mathematical equations, figures, tables, and cross-references; and (6) BibTeX bibliography management. Chapters 5 and 6 were used as extended reference materials for post-training self-study, whereas Chapter 4 was the main pedagogical focus of the training day.

With authorization and contextualization for the academic setting of Universitas Cenderawasih, the module is a straight adaptation of Prayetyo (2022). An appendix containing a pre-made LaTeX thesis template that complied with the conventional formatting guidelines for undergraduate theses (12pt, A4, 3 cm margins, 1.5-line spacing, `\texttt{fancyhdr}` running headers, IEEE bibliography style). The package included two carefully chosen and hyperlinked YouTube video tutorials that covered Overleaf collaborative editing and TexStudio processes, respectively. All participants can access the module via the WhatsApp learning community, which is housed on a shared Google Drive: [https://drive.google.com/drive/folders/1yWXIBk7-xeDVIk2xEG\\_LLM3GPsNXT8Gq?usp=sharing](https://drive.google.com/drive/folders/1yWXIBk7-xeDVIk2xEG_LLM3GPsNXT8Gq?usp=sharing)

#### **5. Post-Training Learning Community**

By the time this paper was submitted, all 26 participants and six more dorm occupants had joined the WhatsApp group "Learning LaTeX Deiyai" that was created during the training session. In the three months after the training, the group has had over ten separate discussion threads on subjects like Overleaf project sharing protocols, bibliography entry formatting, and LaTeX package compatibility issues. The group's natural expansion beyond the initial cohort of participants indicates that the training had a beneficial demonstration effect within the dorm community, as members shared their LaTeX documents with friends who subsequently wanted to learn the same abilities.

A high-leverage result of community service interventions, this viral learning dynamic has been seen in similar technology-introduction programs for underrepresented student groups (Nogueira et al., 2022; Paramitha et al., 2023). The investment in training a seed group yields compounding returns as knowledge spreads through the social network. Follow-up activities scheduled for 2026, such as advanced LaTeX workshops with a particular focus on BibTeX, TikZ diagram drawing, and Beamer presentation design, will be used to track the viability of this learning community.

## 6. Discussion: Implications for Digital Academic Literacy in Eastern Indonesia

The initiative's outcomes add to the increasing amount of data demonstrating how beneficial structured LaTeX instruction is for students with no prior typesetting knowledge. Similar baseline profiles were observed by Sotomayor-Beltran et al. (2021), who discovered that structured instruction resulted in quantifiable increases in document quality and citation accuracy in a Peruvian engineering research course where all participants were LaTeX beginners. The current results show that LaTeX pedagogy is transferable across linguistic and cultural contexts by extending this body of data to an indigenous student population in a remote Indonesian province.

A crucial design element that deserves broader adoption in comparable community service contexts in Indonesia is the dual-platform distribution approach (TexStudio/MikTeX for laptop users; Overleaf for smartphone users). While still below the national average, smartphone internet adoption in Papua is significantly higher than personal computer ownership rates among rural dormitory students (Suratni et al., 2022; poverty reduction study data on Papua's digital infrastructure gap). For most participants, the training eliminated a hardware barrier by making LaTeX available through smartphones.

A structural restriction of one-day intense training formats for intricate, multi-step technical workflows is highlighted by the below-target performance on BibTeX proficiency. This result validates the suggestion made by Kopka and Daly (1999) that bibliography management be taught as a separate module instead of being included in a basic introduction to LaTeX. After participants have had time to solidify their core syntactic abilities, future program designs should either expand the training duration to two days or introduce BibTeX in a dedicated follow-up session around two weeks after the initial introduction.

From a wider angle, this project shows how PKM (community service) programs in Indonesian higher education can effectively transmit digital literacy to marginalized student populations. Despite being modest (Rp 10,000,000, or roughly USD 650), the PNBP funding mechanism was adequate to support a high-impact intervention that reached 26 participants and produced reusable training artifacts with an endless lifespan. Strong institutional value for investment is shown by the cost-per-beneficiary ratio, which compares favorably with similar digital literacy programs reported for remote Indonesian villages (Nogueira et al., 2022).

## CONCLUSION

Students' academic writing skills can be immediately and quantifiably improved by systematic, practice-oriented interventions, as demonstrated by the LaTeX training community service program at the Deiyai Dormitory in Jayapura. The program exceeded the predetermined goal of 80% (+20%) by achieving a 100% success rate in basic document generation with 26 participants and zero initial exposure to LaTeX. This demonstrates that core technical abilities may be successfully transferred even in a one-day training session (about seven hours) with the use of guided activities, contextualized modules, and direct mentoring.

The findings do, however, also show some obvious limits. Only about 30% of advanced competences were attained, which is far less than the goals of 70% (-40%) and 60% (-30%), especially BibTeX integration and independent thesis template generation. This disparity

draws attention to a structural problem: short-term training is insufficient to properly master complicated, multi-step abilities. Furthermore, poor outreach and coordination are indicated by participant attendance (26 vs.  $\geq 40$  objective,  $-35\%$ ), indicating the need for earlier recruitment and better institutional cooperation.

Infrastructure limitations were successfully overcome by the dual-platform strategy (38% laptop users and 62% smartphone users via Overleaf), which made the training inclusive and flexible in low-resource settings. Additionally, the development of a post-training learning community ( $>30$  members;  $>10$  talks in 3 months) suggests long-term effects.

Overall, the program shows great efficacy in reaching short-term learning objectives, but also emphasizes the need for additional training, particularly for advanced LaTeX abilities. To guarantee deeper competitiveness and more engagement, future implementations should be longer or take a modular approach.

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