

Enhancing Teachers' Competence in Developing *ASYIIK* Practicum Guidebooks (Innovative Science Activities in Chemistry Education) at MGMP IPA Semarang, Indonesia

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Abstract. This community service program aims to enhance the competence of science teachers under MGMP IPA Semarang in developing the ASYIIK (Innovative Science Activities in Chemistry Education) practicum guidebook. This initiative was based on the limited use of innovative and curriculum-based practicum guides, as well as the challenges many teachers face in designing engaging and applicable practicum activities. The training involved 60 teachers from 9 schools and was conducted through forum group discussions (FGD), guidebook reviews, and structured monitoring and evaluation. Activities included material presentation, mini-practicum sessions, and assignments related to guidebook development. The results showed that over 78% of participants successfully created practicum guidebooks that met the established criteria, indicating a significant improvement in their competence. The program produced several outcomes, including a publication in a nationally accredited SINTA 4 journal, electronic media coverage, a video highlight, and copyright registration. These findings suggest that the ASYIIK approach fosters contextual learning, integrates 21st-century skills, and improves students' motivation and understanding in chemistry learning. In conclusion, the program reinforces the role of teachers as innovative and relevant designers of meaningful learning experiences.

Keywords: Innovative Science Activities; Practicum Guidebook; Teacher Competence; 21st-Century Skills.

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INTRODUCTION

Improving the quality of education requires teachers to possess strong competencies in designing innovative, relevant, and contextual learning. Practicum is one of the essential components in science education, particularly in chemistry, as it allows students to concretize abstract concepts while simultaneously fostering scientific skills and critical thinking (Murningsih et al., 2016). However, the success of practicum-based learning largely depends on the availability of guidebooks that are systematic, engaging, and applicable (Arini & Darmayanti, 2022).

In practice, many teachers still encounter difficulties in preparing practicum guidebooks that align with the curriculum and address students' needs. A survey conducted by MGMP IPA Semarang City revealed that only 30% of

teachers regularly use standardized guides, while the remaining 70% rely on self-prepared or improvised materials. This situation has reduced the frequency of practicum implementation, which ideally should occur at least five times per semester but is, in reality, carried out only three to four times.

This condition underscores the importance of enhancing teachers' competence in developing practicum guidebooks that are attractive, user-friendly, and based on innovative science activities. Such guidebooks should integrate contextual and scientific elements, along with 21st-century skills (6C), so that students not only understand theories but are also able to apply them actively and creatively (Tukan et al., 2025). Guidebooks with these characteristics are also proven to increase students' interest and learning outcomes (Bundu et al., 2021).

Previous studies have shown that practicum guidebooks developed using scientific and contextual approaches can enhance conceptual understanding and motivation to learn (Rahman et al., 2016). However, most studies have not directly involved teachers in the development process. In fact, engaging teachers in designing their own practicum guidebooks can strengthen their sense of ownership and improve the quality of implementation in classrooms (Ulya & Ardianti, 2020). Therefore, collaborative approaches such as forum group discussions (FGD) are considered effective strategies to support teachers in developing instructional materials.

Based on this background, this program aims to enhance the competence of MGMP IPA teachers in Semarang City in developing the ASYIIK Practicum Guidebook (Innovative Science Activities in Chemistry Education). Through training, discussions, and mentoring, teachers are expected to produce practicum guidebooks that are aligned with the curriculum, responsive to students' characteristics, and grounded in innovative science learning principles.

METHODS

This community service program was carried out in three main stages: preparation, implementation, and evaluation. The activities took place at SMP Negeri 5 Semarang and involved 60 science teachers from 9 junior high schools under the MGMP IPA Semarang.

In the preparation stage, the team coordinated with the head of MGMP IPA Semarang to determine the schedule, venue, and technical implementation of the program. The team also prepared instruments to explore the challenges faced by teachers in developing practicum guidebooks and designed the training materials to be delivered during the sessions.

The implementation stage was conducted through Forum Group Discussions (FGD), facilitated by five speakers from the community service team. The topics presented included: teacher competence in developing learning resources (Prof. Dr. Sri Susilogati Sumarti, M.Si.), the characteristics of chemistry in junior high school (Drs. Eko Budi Susatyo, M.Si.), the structure of practicum guidebooks (Prof. Dr. Endang Susilaningih, M.S.), innovative science activities (Prof. Dr. Sarwi, M.Si.), and the ASYIIK Practicum Guidebook (Prof. Dr. Sri Wardani, M.Si.). In addition to lectures, mini-practicum

sessions were organized to demonstrate simple science activities, such as chemical reactions using plastic bottles, baking soda, and vinegar, as well as acid-base testing with natural indicators like red cabbage and turmeric.

Subsequently, teachers were assigned to develop their own ASYIIK Practicum Guidebooks tailored to the chemistry content taught in their respective schools. The completed guidebooks were submitted via Google Drive and reviewed during the evaluation stage.

The evaluation stage involved reviewing the practicum guidebooks produced by teachers based on the ASYIIK guidebook development criteria. The evaluation was conducted qualitatively and descriptively by the lecturer team to assess the quality of the outputs and their alignment with the principles of innovative science learning. Furthermore, the community service program itself was evaluated to measure the extent to which it enhanced teachers' competence in developing practicum guidebooks, as well as to identify the strengths and weaknesses of the program (Kusumawati et al., 2024).

RESULTS AND DISCUSSION

The community service activities were conducted with 37 science teachers, members of MGMP IPA Semarang City, on April 29–30 and May 2, 2025, at SMP Negeri 5 Semarang. The objective of this program was to enhance teachers' competence in developing the ASYIIK Practicum Guidebook (Innovative Science Activities in Chemistry Education). The activities included forum group discussions (FGD), mini-practicum sessions, and the assignment of preparing practicum guidebooks with direct mentoring from the lecturer team. This model was chosen to address key issues identified in the field, namely the limited use of innovative practicum guidebooks and the difficulties teachers encounter in designing contextual, applicable, and curriculum-based practicum activities (Srirahmawati et al., 2023).

The FGDs were conducted in a structured manner, beginning with presentations from the resource persons, followed by group discussions, and ending with assignments to design practicum guidebook drafts. These activities were also complemented with mini-practicum sessions that served as concrete examples. The sequence of activities included an initial assessment, material reinforcement, guidebook design, limited trials, and evaluation.



Figure 1. Teacher Competence Presentation

The first session, presented by Prof. Dr. Sri Susilogati Sumarti, M.Si., emphasized the importance of teacher competence in designing learning experiences rather than merely delivering content. Teachers with strong pedagogical content knowledge (PCK) are able to design practicum guidebooks that are both applicable and aligned with students' characteristics. To illustrate this, a simple mini-practicum was demonstrated involving a chemical reaction using a plastic bottle, baking soda, and vinegar. This experiment demonstrated that practical work can be effectively conducted using simple, locally available materials while still providing meaningful learning experiences. This underscores that the quality of teachers' competence is directly related to the quality of the practicum guidebooks they produce (Annisa et al., 2024).

Table 1. The Relationship between Teacher Competence and the Quality of Practicum Guidebooks

Teacher Competence	Impact on Practicum Guidebooks
Strong pedagogy	Structured guides, aligned with students' characteristics
Mastery of content	Logical procedures, free from misconceptions
Innovation	Contextual practicums that motivate students

In the following session, Drs. Eko Budi Susatyo, M.Si., highlighted the importance of mastering junior high school chemistry content. Teachers must have a solid understanding of basic concepts such as the properties of matter, elements, compounds, mixtures, and chemical

reactions to avoid misconceptions. Mastery of content enables teachers to design simple yet contextual practicums, for example, separating mixtures using filtration or simple distillation methods that are relevant to students' everyday experiences. In this way, teachers can connect abstract chemical concepts with real-world phenomena, in line with curriculum requirements (Sutrisno et al., 2018).

The next presentation, delivered by Prof. Dr. Endang Susilaningsih, M.S., emphasized the importance of structure in practicum guidebooks. A good guidebook should not only contain procedural steps but also include objectives, result analysis, and reflection. Such a comprehensive structure has been proven to enhance students' scientific skills while fostering an inquiry-based culture (Darmayanti & Haifaturrahmah, 2019). In this activity, teachers were guided to compare the differences between conventional guidebooks and the ASYIHK Practicum Guidebook, which highlights contextual, interactive, and 21st-century skill integration aspects.

Table 2. Differences between Conventional Practicum Guidebooks and ASYIHK Practicum Guidebooks

Aspect	Conventional	ASYIHK
Language	Complex, technical	Easy for students to understand
Focus	Procedural	HOTS and 6C
Student engagement	Passive, following instructions	Active, inquiry-based, contextual
Tools & materials	Standard laboratory equipment	Simple, locally available materials

Following this, Prof. Dr. Sarwi, M.Si., stressed the necessity of innovative science activities. Practicums that are merely procedural are considered no longer relevant to the needs of 21st-century students. Therefore, inquiry-based activities, the integration of STEM/SETS approaches, and the strengthening of 6C skills (critical thinking, creativity, collaboration, communication, computational thinking, and compassion) are highly essential. Such activities transform practicums into effective means of building students' competencies to face the challenges of Society 5.0 (Nurhayati, 2022).



Figure 2. Presentation of the ASYIHK Practicum Guidebook Materials

The final presentation, delivered by Prof. Dr. Sri Wardani, M.Si., introduced the concept of the ASYIHK Practicum Guidebook in a comprehensive manner. The guidebook was designed to be contextual, inspiring, and based on multiple intelligences. One practicum example presented was the use of red cabbage and turmeric as natural acid–base indicators. This simple practicum enabled students to understand the concept of solutions while simultaneously practicing observation, reasoning, and scientific reflection skills (Harta et al., 2023).

The presentation session was held offline on April 29, 2025, at SMP Negeri 5 Semarang, with each speaker delivering their material for approximately 35 minutes. In addition to presenting, Prof. Dr. Sri Wardani, M.Si., conducted a mini-practicum on preparing natural acid–base indicators based on the ASYIHK guidebook. The practicum employed simple, locally available materials, was contextual, and incorporated multiple intelligences (kinesthetic, naturalistic, interpersonal, and intrapersonal). The participating teachers appeared enthusiastic, with some actively trying out the experiment to observe the color changes of the indicators.

The program continued on April 30 and May 2, 2025, with assignments for teachers to develop ASYIHK Practicum Guidebooks tailored to their respective grade levels. This task aimed to assess teachers' competence in designing innovative practicum guidebooks. Through this activity, teachers were expected to develop guidebooks that encourage students to learn through engaging practical work, while enhancing their thinking, scientific, and problem-solving skills. Overall, the training strengthened the readiness of MGMP IPA Chemistry teachers in Semarang City to develop and implement the ASYIHK Practicum Guidebook in schools.

From the assignment results, more than 78% of teachers successfully developed practicum guidebooks that met the ASYIHK criteria. The products produced were diverse, including contextual practicums using local materials, simple chemical reactions, and experiments related to daily life. These findings demonstrate that the combination of FGDs, mini-practicums, and mentoring from resource persons was effective in improving teachers' skills in designing instructional materials (Murti et al., 2022). In addition to producing guidebooks, the program also generated other academic outputs, as presented in Table 3.

Table 3. Outputs of the Community Service Program

Type of Output	Achievement
Scientific publication	Accepted in a SINTA 4-indexed journal
Electronic media coverage	Published in 2 media outlets
Video highlight Copyright (ASYIHK Practicum Guidebook and FGD highlight video)	Available on YouTube https://youtu.be/aKT8r0B2eXM
Teacher competence	Registered Achieved: >78% met the criteria (27 out of 35 teachers submitted assignments meeting the standards)

In general, the improvement in teachers' competence was achieved through a combination of FGD strategies, expert material delivery, mini-practicums, and systematic mentoring. Teachers became more skilled in developing innovative and contextual guidebooks, enabling students to understand chemistry concepts more meaningfully (Rasmani et al., 2023). Furthermore, the ASYIHK Practicum Guidebook model has the potential to be replicated in other science subjects or in schools with limited laboratory facilities. Thus, this study contributes to science education by reinforcing the paradigm that contextual and innovative practicums can bridge the gap between theory and practice, while also fostering students' 21st-century skills and enhancing the professionalism of science teachers (Nuai & Nurkamiden, 2022).

CONCLUSION

This community service program successfully enhanced the competence of science teachers in MGMP Semarang City in developing the ASYIHK Practicum Guidebook (Innovative Science Activities in Chemistry Education). Through forum group discussions, mini-practicum sessions, and direct mentoring from experts, teachers were able to design practicum guidebooks that are contextual, inspiring, interactive, and aligned with curriculum demands. These findings address the issue of the limited use of innovative practicum guidebooks in schools and demonstrate that collaborative approaches supported by concrete examples are effective in strengthening teachers' pedagogical and professional skills. The contribution of this study to science education lies in the ASYIHK Practicum Guidebook model, which bridges the gap between theory and practice, fosters 21st-century skills, and can be replicated in other science subjects to support contextual learning in schools with limited laboratory facilities.

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