
The Use of Instagram in Learning Voltaic Cells through Small-Scale Chemistry Practicum: A Needs Analysis

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Article Info

Article history:

Received : October 1st, 2025

Revised : October 30th, 2025

Accepted : October 30th, 2025

Available online : October 31st, 2025

<https://doi.org/10.33541/edumatsains.v10i2.7388>

Abstract

The development of social media opens new opportunities for innovation in learning, particularly in chemistry subjects. Instagram, as one of the most popular platforms, holds great potential to be used as a learning medium because it is easily accessible and capable of presenting engaging visual content. In this study, the implementation of the Small Scale Chemistry (SSC) practicum through Instagram was carried out by presenting tutorial videos, digital practicum guides, and interactive discussions via posts and comments, allowing students to learn and conduct simple experiments using safe and easily available materials. The small-scale chemistry (SSC) ethnosience-based practicum approach is considered effective in overcoming the limitations of school laboratory facilities by using fewer chemicals, being cost-efficient, safe, and environmentally friendly. The voltaic cell, as one of the electrochemistry topics, is still often perceived as difficult for students to understand if taught only theoretically, thus requiring more practical and relevant learning media. This study aims to analyze the need for integrating Instagram into small-scale chemistry practicum on the topic of voltaic cells. The method employed was a descriptive survey by distributing questionnaires to students and chemistry teachers in one senior high school in Kepanjen Regency. The questionnaires used a five-point Likert scale ranging from "strongly disagree" to "strongly agree." The teacher questionnaire consisted of 30 Likert-scale items and 2 open-ended questions, while the student questionnaire contained 57 Likert-scale items and 4 open-ended questions. The results show that 64.4% of students agreed and 25.3% strongly agreed on the need for developing an innovative practicum medium that integrates the concepts of small scale chemistry, ethnosience, and Instagram to support voltaic cell learning. Similarly, 66.7% of teachers strongly agreed and 33.3% agreed that such integration can enhance student engagement, reduce laboratory costs and waste, and overcome limited facilities. These

findings indicate a high level of support from both students and teachers for the development of SSC-based learning media integrated with Instagram to improve students' understanding of the voltaic cell concept.

Keywords: Instagram Social Media Platform, Chemistry Practicum, Voltaic Cell, Ethnoscience

1. Introduction

Social media as a learning platform has developed rapidly and is now widely utilized by both teachers and students as an essential part of the e-learning experience. This platform not only serves as a means of exchanging information on important topics but also enables communication to take place anytime and anywhere (Haleem et al., 2022). Social media has increasingly been adopted by educators in schools and universities as a learning support tool (Rokhim et al., 2022). One of the most popular social media platforms is Instagram, which is used to share information through photos, images, and videos (Atmoko, 2012). Instagram is also considered to have potential as a learning medium because of its widespread use and easy accessibility via digital devices such as smartphones and laptops (Aprilizdihar et al., 2022). Through social media, students can gain additional knowledge, engage in discussions, and stay connected with teachers even when they are in different locations (Milman, 2015). Visualizations in the form of images and videos can also help students observe phenomena, collect data, and draw conclusions, thereby enhancing learning motivation (Fajri et al., 2023).

The ease of access to technology and the widespread use of social media make it not only a communication tool but also a valuable means to improve the learning process (Hanif & Imran, 2022). Social media also allows educational content to be shared widely and quickly (Kaur & Gurnani, 2022). Several studies have explored the use of Instagram as a learning medium in different educational contexts, such as in organic chemistry (Korich, 2016), mass communication (Ang et al., 2017), and various high school chemistry topics, including reaction rates (Rahmawati et al., 2023; Rose, 2023; Widarti et al., 2023; Widarti et al., 2024), hydrocarbons (Rokayah et al., 2021), qualitative analysis (Rokhim et al., 2022), acids and bases (Syafuruddin et al., 2024), and cation analysis (Widarti et al., 2022). However, there has been no report on the integration of Instagram in small-scale chemistry laboratory learning.

The use of Instagram in chemistry practicum learning provides opportunities to present experimental steps, material explanations, and visual demonstrations in an attractive and easy-to-understand way. Teachers can upload tutorial videos, experiment simulations, or short explanations in story and reel formats that allow students to review the material repeatedly. Comment sections can also function as discussion forums, enabling interaction between teachers and students beyond classroom hours. This integration supports independent learning, increases flexibility, and helps students visualize experimental concepts before or after the actual practicum.

Small-scale chemistry is an innovative approach in laboratory learning that uses simple tools and fewer materials while maintaining meaningful experimental experiences. Micro-scale

laboratories or small-scale laboratory activities reduce the use of chemicals (Y. A. S. Anwar et al., 2023). According to Hidayah et al. (2022), Small-Scale Chemistry (SSC) minimizes the use of laboratory materials and waste in laboratory activities. This approach can also reduce laboratory workload compared to conventional macro-scale laboratories (Hidayah et al., 2023). Mayo et al. (2015) explain that SSC emphasizes investigation with minimal chemical use without changing the principles of experimentation. It helps reduce costs, minimize waste, and improve laboratory safety (Ratnasari et al., 2019), making it suitable for schools with limited laboratory facilities in terms of equipment, materials, human resources, and time. The use of local materials through an ethnoscience approach can make learning more relevant to students' daily lives while fostering environmental awareness. Through ethnoscience-based chemistry learning, students can understand and explain concepts related to chemical reactions, structures, and compositions of materials, making it easier to connect scientific ideas with everyday experience (Astiningsih & Partana, 2020).

One of the important chemistry topics studied through practicum is the voltaic cell. This concept is closely related to daily life phenomena, such as batteries and other energy sources. A voltaic cell is an electrochemical cell where chemical energy from a spontaneous redox reaction is converted into electrical energy (Sutantri, 2022). The voltaic cell consists of an anode and a cathode, where the electron transfer produces electrical energy (Harahap, 2016). It is often considered a complex topic because of its abstract concepts (Nabella & Dwiningsih, 2022) and requires factual, conceptual, and procedural understanding (Tiara et al., 2025). Students frequently find it difficult when the material is taught only theoretically. Sukmawati (2019) reported that students studying voltaic cells often memorize rather than understand the underlying concepts, and misconceptions are common (Sutantri, 2022; Rahayu et al., 2022).

Developing learning media that relate voltaic cell concepts to everyday life can help students understand the topic more effectively (Tiara et al., 2025). The use of Instagram in small-scale chemistry practicum for voltaic cells can help visualize experiments, display tutorial videos, and provide interactive discussions through comment features. This makes learning more flexible, engaging, and accessible anytime. Based on this rationale, a needs analysis was conducted to explore the potential integration of Instagram into small-scale chemistry learning for voltaic cell experiments. The analysis aims to determine students' and teachers' needs for this innovation and how it can improve the quality of chemistry learning in high schools.

2. Methods

2.1. Type of Research

This study is a needs assessment survey research based on preliminary observations at SMAN 1 Kepanjen and questionnaires distributed to students and teachers regarding their perceptions of using Instagram as a learning medium for voltaic cell practicum with a small-scale chemistry concept. The questionnaire aimed to explore the extent to which students and teachers feel supported by the use of social media in the chemistry learning process, particularly on the voltaic cell topic that involves small-scale laboratory practice.

2.2. Data Collection Technique

The data collection technique in this study used a needs assessment questionnaire for teachers and students. Two types of questionnaires were designed for different respondent groups: teachers and students. Each consisted of two sections: the first concerning respondent identity, and the second concerning their experiences with chemistry practicum as well as perceptions of voltaic cell learning typically conducted. The student questionnaire included questions on topics such as content understanding, the relevance of practicum to everyday life, and their experiences using standard laboratory equipment and materials as well as those based on small scale chemistry. It also covered the use of social media (Instagram) in learning the voltaic cell practicum. In this section, students were asked to evaluate the use of social media in learning and whether they felt the Instagram platform could enrich their learning experience. In addition, some questions explored how the use of materials from the surrounding environment (such as batik waste or Lapindo mud) could influence their flexibility, engagement, and understanding of voltaic cell concepts.

The teacher questionnaire, on the other hand, asked chemistry teachers to evaluate the voltaic cell topic, challenges faced in practicum implementation, and the relevance of the practicum to students' daily lives. Teachers were also asked to give their opinions regarding the use of small scale chemistry concepts, digital media integration, and the potential use of Instagram as a learning medium to enhance flexibility, engagement, and student understanding.

The collected data were analyzed descriptively by calculating the percentage of responses in each category (strongly agree, agree, neutral, disagree, and strongly disagree). The interpretation of the data focused on identifying the level of agreement among teachers and students regarding the need for innovation in voltaic cell practicum learning. A higher percentage of agreement (agree + strongly agree) was interpreted as a strong indication of the necessity and potential feasibility of integrating small scale chemistry, ethnoscience, and Instagram into chemistry learning.

2.3. Research Subjects

This study involved two groups of respondents: students and teachers. The student respondents consisted of 87 students who had participated in the voltaic cell practicum at school, while the teacher respondents consisted of three chemistry teachers with experience teaching the voltaic cell practicum.

2.4. Data Analysis Technique

Data from the questionnaires filled out by respondents via Google Forms were analyzed descriptively and qualitatively. A total of 30 students and 9 chemistry teachers participated in this study. The teacher questionnaire consisted of 30 closed-ended questions and 2 open-ended questions, while the student questionnaire contained 57 closed-ended questions and 4 open-ended questions. All closed-ended items used a five-point Likert scale (1–5), ranging from strongly disagree (1) to strongly agree (5). The closed-ended questions were analyzed using Microsoft Excel to calculate frequencies and percentages, while the open-ended questions were examined using a qualitative descriptive approach to identify the main emerging themes and provide contextual interpretation of the responses.

3. Result and Discussion

The results of the needs analysis on the use of Instagram as a social media platform in small-scale chemistry (SSC) practicum of voltaic cells were obtained based on preliminary observations and questionnaire data. The questionnaire, in the form of a Google Form, was completed by 87 students who had previously participated in voltaic cell practicum and 3 chemistry teachers. The purpose of this process was to analyze the importance of developing learning media to achieve learning objectives. This is in line with the statements of Cahyadi (2019) and Fauziah et al. (2021), which emphasize that preliminary analysis aims to collect initial information.

3.1. Analysis of Students' Conceptual Understanding of Voltaic Cells

The first analysis conducted was related to students' understanding of the voltaic cell concept after laboratory practicum using standard facilities without the aid of digital media. Based on the questionnaire, several results of the analysis were obtained as follows.

Table 1.

Students' Understanding of the Voltaic Cell Concept

No.	Aspect	Analysis Result
1	Frequency of attending chemistry practicum	The majority of students frequently participate in chemistry practicums at school
2	Understanding of voltaic cell concepts in class	More than 50% of students find the voltaic cell material difficult to understand
3	Experience in conducting voltaic cell practicum	Most students have conducted voltaic cell practicums, but limited to standard solutions
4	Benefits of voltaic cell practicum for understanding	52.9% of students feel that the voltaic cell practicum has not helped them understand the concept of voltaic cells

Based on the results in Table 1, the majority of students had frequently conducted chemistry practicums; however, these were still limited to standard solutions, making them less contextual to students' daily lives. Some students also felt that such practicums had not significantly helped them in gaining a deeper conceptual understanding. Conceptual understanding can be achieved through contextual practicum-based learning. Contextual learning engages students in understanding material by connecting it to real-life situations, encouraging them to apply knowledge in everyday life (Aprilia et al., 2024). This approach focuses on real-world experiences, higher-order thinking, and student-centered learning, thereby enhancing students' critical and analytical thinking skills (Sufianto, 2019).

3.2. Analysis of the Relevance of Voltaic Cell Practicum to Students' Daily Lives

The next analysis concerns students' opinions regarding the relevance of the voltaic cell practicum to their daily lives.

Table 2.
Relevance of Voltaic Cell Practicum to Daily Life

No.	Aspect	Analysis Results
1.	Relevance of the voltaic cell practicum to daily life	57.5% of students felt that the voltaic cell practicum was not relevant to their daily lives.
2.	Experience of conducting a voltaic cell practicum using available materials	55.2% of students reported never conducting a voltaic cell practicum using materials available around them.
3.	Practicum with environmental materials (batik waste, Lapindo mud)	The majority of students believed this would make learning more interesting and relevant. None of the students disagreed.
4.	Practicum with everyday materials improves understanding	Most students agreed because they could directly observe the application of the voltaic cell concept.

Students assessed the voltaic cell practicum as fairly relevant, but not yet fully connected to their daily lives. They also felt more interested if the practicum used materials from the surrounding environment, such as batik waste. This indicates that contextual learning captures students' attention more effectively and helps bridge theory with practice. To create meaningful learning, chemistry instruction can be connected to students' cultural experiences or environmental phenomena they encounter in daily activities (Whatoni et al., 2024). The integration of local cultural elements in science learning can be realized through the concept of ethnoscience, which provides opportunities to enhance the relevance of learning for students (Wiraningtyas, 2024). Mukti et al. (2022) state that the ethnoscience approach in science learning not only improves students' understanding of scientific concepts but also fosters a sense of pride in their own culture.

3.3. Analysis of Small-Scale Chemistry Practicum Experiences

The next analysis concerns students' experiences in using tools and materials within the concept of small scale chemistry.

Table 3.
Experiences in Using Tools and Materials for Practicum

No.	Aspect	Analysis Result
1.	Practicum with the concept of small scale chemistry	The majority of students have never conducted a practicum using the small-scale chemistry concept.
2.	Practicum with surrounding materials	Most students agreed that conducting practicum with materials from the surrounding environment would make learning more engaging and relevant. Students would also be able to directly observe the application of voltaic cell concepts.
3.	Implementation of small scale chemistry practicum with surrounding materials	All students agreed that conducting chemistry practicum using the small scale concept with local materials is beneficial.
4.	Interest in small scale chemistry practicum using surrounding materials	All students expressed interest in participating in a voltaic cell practicum using a small-scale laboratory approach with locally sourced materials, compared to using standard laboratory equipment.

Based on Table 3, the majority of students have never conducted a practicum using the small-scale chemistry concept. They are also not very familiar with the concept of small scale chemistry practicum. Most students are interested in practicum activities based on small scale chemistry using materials from their surrounding environment. Such practicum is considered more relevant, cost-effective, and environmentally friendly since it produces less waste. Small scale chemistry (SSC) is an approach that minimizes the use of laboratory materials and waste in laboratory activities (Hidayah et al., 2022). This approach can reduce the use of chemicals by up to 1000 times compared to standard laboratory practices. The SSC approach has gained more recognition because, in addition to enabling efficient and cost effective learning (Duarte et al., 2017), it is also more environmentally friendly (Istiqomah, 2022). Imaduddin et al. (2020) also stated that SSC can reduce costs by utilizing simpler and more affordable equipment.

Learning practices with the SSC concept can strengthen students' thinking skills, as this method encourages them to think more critically and analytically in understanding chemical concepts (Bradley et al., 2021; Ali et al., 2024). Moreover, the use of Small-Scale Chemistry (SSC) has been proven effective in enhancing students' conceptual understanding (Supasorn, 2022). Through this approach, students not only become more active in the learning process but also connect theory with practice, thereby reinforcing conceptual comprehension (Urbano et al., 2022). In this way, learning becomes more meaningful, leading to a significant improvement in student learning outcomes (Syaadah et al., 2020; Ezeudu et al., 2019).

3.4. Analysis of the Use of Social Media (Instagram) in Voltaic Cell Practicum Learning

The next analysis concerns students' perceptions regarding the use of Instagram in voltaic cell practicum learning.

Table 4.

The Use of Instagram in Voltaic Cell Practicum Learning

No.	Aspect	Analysis Results
1.	Instagram ownership and activeness	All students have an Instagram account and actively use it.
2.	Ease of learning through videos/online tutorials	79.3% of students agree that material is easier to understand through digital visual media.
3.	Instagram enriches the learning experience	86.2% of students agree that using social media platforms such as Instagram for learning voltaic cell practicum will enrich their learning experience.
4.	Digital technology (videos/discussion forums) increases interest	85.1% of students are more interested in learning when using digital technology platforms.
5.	Instagram enables access anytime & anywhere	All students agree that digital media can support flexible self-learning.
6.	Use of Instagram as a discussion platform between peers and teachers	80.4% agree that Instagram can be used as a space for academic communication.

The data presented in Table 4 provide clear insights into how Instagram contributes to the learning process of the voltaic cell practicum through several key aspects. The high level of ownership and activeness (100%) shows that all students are already familiar with and actively use Instagram, making it a highly accessible platform for learning purposes. The high percentage of agreement on the aspects of learning convenience through videos (79.3%) and enriched learning experience (86.2%) indicates that Instagram's visual and interactive features—such as videos, reels, and image posts—help students better understand complex electrochemical concepts and make laboratory activities more engaging. Furthermore, the flexibility aspect highlights that Instagram enables students to access learning materials anytime and anywhere, while the interaction aspect demonstrates its role in supporting communication between peers and teachers through comments, direct messages (DMs), and group discussions.

These findings reinforce that Instagram is not merely a platform for entertainment but can also be optimized as an effective learning tool that promotes collaboration, motivation, and independent learning. This result aligns with previous studies reporting that most students use Instagram for entertainment, obtaining information, updating daily activities, and building social

networks (Cahyadi & Setiawan, 2020; Mahendra et al., 2017). By utilizing Instagram's visual features such as photos, videos, and reels, teachers can design more appealing and contextual learning content that increases students' interest in understanding chemistry concepts (Anggreani et al., 2023). Instagram effectively captures students' attention during learning because it provides concrete visual illustrations of abstract materials (Budge, 2017; Jatmiko, 2016). Moreover, the integration of Instagram into chemistry learning supports flexibility and self-directed learning (Anggreani et al., 2023; Rokayah, 2023) and has been proven to improve students' learning motivation, critical thinking skills, and academic achievement (Widarti, 2023; Widarti, 2024a; Widarti, 2024b).

3.5. Analysis of Students' Perceptions toward the Integration of Instagram in Small-Scale Chemistry-Based Voltaic Cell Practicum Learning

The final analysis discusses students' needs for integrating digital platforms into voltaic cell practicum learning based on small scale chemistry and ethnosience.

Table 5.

Students' Perceptions of the Integration of Instagram in Small-Scale Voltaic Cell Practicum Learning

No.	Aspect	Analysis Result
1	Digital media integrated practicum	The majority of students are interested in conducting practicums integrated with digital media.
2	Need for innovation	89.7% of students fully supported the innovation of developing small-scale laboratory media integrated with the Instagram platform, indicating a high level of agreement toward the need for such instructional innovation

Most students admitted that they had never participated in practicums integrated with digital media, nor with the concepts of small-scale chemistry and ethnosience. Therefore, all respondents agreed that such an instructional innovation should be implemented. Students need new learning innovations that integrate digital technology and local wisdom to enhance their engagement and understanding. The integration of ethnosience-based digital technology in chemistry learning—through the use of digital resources such as interactive simulations, virtual laboratories, experimental videos, and online scientific journals—allows students to more easily explore chemical concepts that are difficult to visualize, while also connecting them with familiar cultural practices, thereby making the material easier to understand (Suparwati et al., 2023; Dal et al., 2020).

3.6. Analysis of the Use of the Small-Scale Chemistry (SSC) Concept in Voltaic Cell Practicum Learning

The next analysis is based on the results of the teacher questionnaire, with the first part aiming to understand how teachers assess the potential implementation of the small-scale chemistry (SSC) concept in voltaic cell practicum learning.

Table 6.
Teachers' Perceptions of Small-Scale Chemistry Practicum

No.	Aspect	Analysis Result
1	Teachers' understanding of the SSC concept	66.7% not familiar, 33.3% somewhat familiar; most teachers are still not well-acquainted with SSC.
2	Benefits of SSC practicum	66.7% agree and 33.3% strongly agree that SSC can serve as an alternative to overcome cost barriers in chemistry practicums, and also minimize laboratory waste.
3	Implementation of SSC in schools	66.7% never, 33.3% occasionally; most teachers have never implemented the SSC concept in schools.
4	Potential use of culturally relevant materials (e.g., batik waste)	66.7% agree, 33.3% strongly agree; teachers believe that practicum using locally available materials can make learning more engaging.
5	Relevance of ethnoscience-based SSC	100% agree that SSC can enhance students' learning experiences and the relevance of instruction.

Based on the questionnaire results, most teachers are not yet familiar with the concept of SSC, although they recognize the significant potential of this practicum approach in addressing cost constraints and minimizing waste. The limited implementation of SSC in schools is influenced by a lack of knowledge and the habit of relying on standard laboratory materials. Teachers showed positive enthusiasm when asked about the potential application of SSC by utilizing materials from the surrounding environment, such as batik waste. All teachers agreed that the SSC practicum concept using locally available materials could enhance learning experiences and make learning more engaging. The theory of contextual teaching and learning (Johnson, 2002) states that learning becomes more meaningful when connected to students' real-life experiences. The integration of SSC with local culture not only reduces costs but also makes practicum activities more relevant to daily life.

3.7. Analysis of Teachers' Perceptions of the Potential Integration of Digital Media in Voltaic Cell Practicum

The final analysis concerns teachers' perceptions regarding the possible use of the digital platform Instagram in ethnoscience based SSC practicums as a means to enrich students' learning experiences in understanding the concept of the voltaic cell.

Table 7.

Teachers' Perceptions of Digital Media Integration in Voltaic Cell Practicum

No.	Aspect	Analysis Results
1	Use of digital media in voltaic cell practicum	66.7% never, 33.3% occasionally; digital integration is still rarely conducted by teachers
2	Potential of digital media to enrich learning experiences	66.7% agree, 33.3% strongly agree; teachers support digital media integration in practicum learning
3	Role of social media (Instagram) in enhancing student interest, understanding, and self-learning flexibility	66.7% agree, 33.3% strongly agree; most teachers believe Instagram can improve learning interest, student understanding, and flexibility (self-learning)
4	Innovation in integrating SSC + ethnoscience + Instagram	100% agree/strongly agree; teachers consider this innovation necessary to develop

The questionnaire results show that the use of digital media, particularly Instagram, has not been widely utilized in voltaic cell practicum learning. Most teachers stated that they had never integrated digital technology into practicum learning, although almost all of them acknowledged that it could enrich students' learning experiences. Teachers identified Instagram as a potential platform to enhance student interest, engagement, and understanding. Instagram-based learning media can facilitate students in understanding the learning material through diverse forms of content such as photos and videos (Hajar et al., 2025). Mayer (2019) states that combining multiple representation formats (such as images, text, and audio) can improve comprehension and information retention. Attractive and interactive visualizations can stimulate students' curiosity, encouraging them to ask questions and engage more actively in the learning process (Arsyad et al., 2024). Furthermore, teachers also agreed that Instagram can support self-learning and learning flexibility. Instagram provides convenience and flexibility in communication without spatial limitations, thereby enabling students' self-learning flexibility (Lovina et al., 2021). Therefore, teachers fully support the innovation of developing SSC ethnoscience practicum media integrated with Instagram in voltaic cell material. Full support for the integration of SSC, ethnoscience, and Instagram demonstrates the alignment between the needs of teachers and students. Thus, research

on the development of Instagram-integrated practicum media in voltaic cell practicum learning is not only relevant but also has great potential to be implemented in schools.

4. Conclusion

The results of this study show that both students and teachers equally need innovation in voltaic cell learning. Students feel that the existing practicum has not optimally supported their understanding of voltaic cell concepts because it is not yet contextualized with their daily lives. The practicum is only carried out using standard laboratory materials. Students' learning resources are also limited to textbooks and information from teachers, resulting in low learning flexibility. Furthermore, chemistry teachers at SMA Negeri 1 Kepanjen are not yet familiar with the concept of small-scale chemistry practicum and have never implemented practicum activities contextualized with students' daily lives. The integration of technology into practicum learning has also not been optimally realized, even though students have access to various media platforms that could actually be utilized by teachers. Therefore, both students and teachers support the innovation of developing small-scale chemistry practicum media integrated with Instagram, as it is considered capable of minimizing cost and laboratory waste constraints, while also enhancing interest, engagement, and learning flexibility.

5. Acknowledgments

The authors would like to express their deepest gratitude to the teachers and students of SMA Negeri 1 Kepanjen for their valuable participation and contributions to this research. Sincere appreciation is also extended to the Master's Program in Chemistry Education, Universitas Negeri Malang, for the guidance and academic support provided throughout the study.

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