SOCIETY: Jurnal Pengabdian Masyarakat,
Vol. 5, No. 2 (2026): Maret, pp. 277-287
E-ISSN:2827-878X (Online -Elektronik)

Codeless Data Science with KNIME: Data Analysis and Optimization Without Coding

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ARTICLE INFO

Article history

Received : 20-1-2026

Revised : 11-3-2026

Accepted : 18-3-2026

Keywords

Data Science; Codeless; Data Analyze;KNIME, Webinar; Workshop.

ABSTRACT

In the era of digital transformation, data analysis skills have become essential competencies for students and the general public. However, data science learning is often perceived as complex due to its reliance on programming skills. To address this issue, a community engagement program in the form of a webinar and workshop entitled "Codeless Data Science Using KNIME: Data Analysis and Optimization without Coding" was conducted. This program aimed to enhance participants' literacy and understanding of fundamental data science concepts through a codeless approach using the KNIME Analytics Platform. The activity was implemented in two main stages: a webinar session focusing on conceptual explanations and the data science workflow, followed by a hands-on workshop session involving practical data analysis and predictive modeling through visual workflows without coding. Program evaluation was conducted using a post-activity feedback questionnaire. The results indicated that 69.4% of participants were very satisfied, 22.2% were satisfied, 5.6% felt neutral, and 2.8% were dissatisfied with the overall implementation. These findings demonstrate that the majority of participants responded positively to the materials, delivery methods, and overall organization of the activity. Therefore, this community engagement program can be considered effective in promoting inclusive and accessible data science learning through a codeless approach.

A. INTRODUCTION

The accelerating pace of digital transformation across sectors—from government agencies to private enterprises and academic institutions—has fundamentally shifted organizational priorities (Arnaud, et al., 2025). Institutions now recognize that data represents far more than raw information; it constitutes a strategic resource capable of driving informed decision-making, operational efficiency, and competitive advantage (Kim, Suh, & Kim, 2024). This recognition has catalyzed an urgent demand for professionals and stakeholders equipped with competencies in data interpretation, analytical workflows, and information- driven problem-solving (Diningrat, Rizky, Oley, Natih, & Astini, 2022).

In the Indonesian context, this imperative is particularly acute. The government's strategic roadmaps, including the Indonesia Digital Roadmap and Making Indonesia 4.0 initiative, have set ambitious targets for workforce digitalization, projecting that over 12 million Indonesians will require skills development to remain competitive within labor markets over the next five years (Diningrat, Rizky, Oley, Natih, & Astini, 2022). Current assessments reveal that approximately 50% of the Indonesian labor force possesses only basic digital competencies, creating a substantial talent gap between workforce capacity and industry requirements. Among advanced digital capabilities, data analysis and visualization have been identified as priority skill sets, with 56.7% of Indonesian employees acknowledging their importance for career progression and organizational success (Suhada, et al., 2026).

Despite growing acknowledgment of data literacy's strategic value, significant barriers constrain widespread skill acquisition. The conventional pathway to data science proficiency—requiring advanced programming competencies in languages such as Python or R—presents formidable obstacles for non-technical professionals, students without computer science backgrounds, and members of the general public seeking to enhance their digital competencies (Bonnell, Coppo, & Smith, 2022). The steep learning curve associated with code- based approaches not only extends the timeline for skill acquisition but also discourages entry from diverse population segments (Zou, Zhang, & Liu, 2025).

Based on the challenges related to limited accessibility to data science education and the growing demand for data literacy skills, this community engagement program aims to introduce and promote codeless data science learning using the KNIME Analytics Platform. Specifically, the objectives of this program are: (1) to improve participants' understanding of fundamental data science concepts, (2) to provide practical experience in performing data analysis using a visual workflow approach without programming, and (3) to evaluate the effectiveness of webinar and workshop-based learning activities in enhancing participants' data literacy and analytical skills.

Indonesia faces compounded challenges in this regard. Educational infrastructure disparities between urban and regional centers, limited access to specialized data science training programs outside metropolitan areas, and the predominance of non-technical academic backgrounds among university students collectively restrict opportunities for meaningful skill development (Diningrat, Rizky, Oley, Natih, & Astini, 2022). Furthermore, financial constraints constitute another formidable barrier; high costs associated with premium training programs and certifications limit access among lower- income populations and informal sector workers who form a substantial segment of Indonesia's labor force (Suhada, et al., 2026).

Recent technological innovations have introduced viable alternatives to traditional programming-centric approaches. The emergence of no-code and low-code analytics platforms has created pathways for democratizing data science by decoupling analytical capability from programming expertise (Ajimati & Hassan, 2024). These platforms employ visual, node-based interfaces, allowing practitioners to construct sophisticated analytical workflows through intuitive graphical representations and pre-

built functional components, thereby circumventing the necessity to manually compose code (IARJSET, 2025).

Among available options, the KNIME Analytics Platform—an open-source software solution—stands out as particularly suited for educational and community engagement contexts (KNIME, 2024). KNIME provides an integrated environment combining visual workflow construction, extensive preprocessing and modeling capabilities, and seamless integration with popular programming languages and external data sources (Forkan, Kang, Shekhar, Tomko, & Hu, 2023). Empirical evidence from educational implementations demonstrates that such visual workflow approaches significantly enhance comprehension of analytical processes: users employing visual workflow representations achieve statistically significant improvements in understanding data science procedures compared to code-only approaches. Organizations spanning automotive, technology, and healthcare sectors have successfully leveraged KNIME to achieve large-scale workforce upskilling; for instance, a major automotive manufacturer trained over 1,500 employees in data science applications through KNIME, fundamentally shifting organizational culture toward data-driven decision- making (KNIME, 2024).

Recognizing these intersecting dynamics—mounting workforce demand for data competencies, persistent accessibility barriers, and emerging technological solutions—a community-focused initiative was developed and implemented. Structured as a series of webinars and hands-on workshops titled "Codeless Data Science Using KNIME: Data Analysis and Optimization without Coding," this program directly addressed the need for inclusive, practical, and accessible pathways to data literacy development (Mutoni Uwase, Li, & Chen, 2025).

The program's pedagogical approach synthesized conceptual instruction with experiential learning, combining sessions elucidating foundational data science principles with practical demonstrations and participant-led exercises using KNIME. Participants engaged with authentic datasets, constructed analytical workflows for real-world scenarios, and experienced tangible application of theoretical concepts—all without requiring programming expertise (Pei, Liu, Shih, & Kuo, 2022).

This initiative carries broader significance within the higher education context. Universities and academic institutions across Indonesia are actively integrating community service (pengabdian kepada masyarakat) into their core missions as a dimension of the Tri Dharma Perguruan Tinggi—the three pillars encompassing education, research, and community engagement (Ismawan, 2022). Such community-directed programs fulfill multiple functions simultaneously: they channel institutional expertise toward public benefit, respond to tangible societal needs, and contribute to developing human capital essential for economic competitiveness and social resilience (Mutoni Uwase, Li, & Chen, 2025).

By introducing codeless data science methodologies to diverse community segments, this initiative simultaneously addresses three interconnected challenges: (1) expanding access to technical training beyond traditional gatekeepers and institutional boundaries, (2) equipping participants with competencies aligned with labor market demands, and

(3) demonstrating viable models for institutions to contribute meaningfully to digital transformation across Indonesia's regions and sectors (Siagian, Lubis, & Nasution, 2024). In this sense, the program exemplifies how educational institutions can leverage emerging technologies and innovative pedagogies to fulfill both their public missions and national development objectives.

B. METHODS

This community engagement program was conducted in the form of an online webinar and workshop by applying a codeless data science approach using the KNIME Analytics Platform. The implementation method was designed to provide participants with both conceptual understanding and practical skills in performing data analysis without programming.

The program was carried out in two main stages. The first stage was a webinar session, which focused on delivering conceptual materials related to an introduction to data science, the importance of data literacy in the digital era, and an overview of the codeless approach using KNIME. During this session, participants were introduced to the data science workflow, types of data analysis, and the main features available in the KNIME Analytics Platform.

The second stage was a workshop session, emphasizing hands-on practice in visual data analysis. Participants were guided through the installation of KNIME, familiarization with the working interface, construction of data analysis workflows, and execution of data processing and visualization using available nodes without writing any programming code. The workshop was conducted interactively with direct assistance from the instructors and the organizing team.

Program evaluation was carried out using a post-activity feedback questionnaire distributed to participants after the completion of all sessions. The questionnaire was used to assess participants' satisfaction with the materials, delivery methods, speakers, and overall implementation of the program. The evaluation results were then analyzed descriptively using percentage analysis to identify participants' responses to the community engagement activity.

C. RESULTS AND DISCUSSION

The community engagement program in the form of a webinar and workshop entitled "Codeless Data Science Using KNIME: Data Analysis and Optimization without Coding" was successfully implemented according to the planned schedule. The program was attended by participants from diverse backgrounds who were interested in improving their data literacy and understanding of data science without programming. The following is a series of events for the Webinar and Workshop activities:

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Table 1. Rundown

Time	activity	PIC
07:30 – 09:00 AM	Committee Preparation	Committee
09:00 – 09:05 AM	Opening	Khoirudin Sidik
09:05 – 09:15 AM	Singing National Anthem *Indonesia Raya* and *Mars Muhammadiyah*	Muhammad Ajar Danu
09:15 – 09:20 AM	Welcoming Remarks by the Chairperson	Ahmad Faiz Dermawan
09:20 – 09:25 AM	Speaker Profile Presentation	Azril Ferdiansyah
09:25 – 10:00 AM	Webinar Session	Maulana Faiz
10:00 – 10:15 AM	Q&A Session	Azril Ferdiansyah
10:15 – 11:15 AM	Workshop Session	Ahmad Faiz Dermawan
11:15 – 11:30 AM	Q&A Session	Azril Ferdiansyah
11:30 – 11:35 AM	Group Photo Session	Khoirudin Sidik
11:35 – 11:40 AM	Closing	Khoirudin Sidik

1.1. Phase 1 (Activity Socialization and Creating Event Requirements Documents)

At this stage, the authors and the implementation team carried out an open socialization of the activity through various social media platforms to reach potential participants who were interested in the topic of codeless data science using KNIME. This socialization was conducted by disseminating a visually appealing and informative digital flyer containing essential information about the activity, such as the event title, schedule, speakers, implementation platform, and registration procedures. The flyer was designed to attract participants from diverse backgrounds, particularly students who have an interest in data analysis and the development of digital skills.

Figure 1. Flyer

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E-ISSN:2827-878X (Online -Elektronik)

In addition to the socialization activities, the team prepared several supporting documents to ensure the smooth technical implementation of the webinar and workshop. These documents were created using Google Forms to simplify data collection and management processes. A registration form was developed to gather participants' basic information, including name, institution, email address, and background, which also functioned as a mandatory requirement for participation.

Moreover, a pre-test instrument was designed to measure participants' initial understanding of data science concepts and the application of codeless data analysis using KNIME. The pre-test served as a baseline for evaluating participants' knowledge prior to the activity. Subsequently, a post-test was distributed at the end of the program to assess the improvement in participants' understanding after attending the webinar and workshop sessions.

An attendance and feedback form was also provided to record participant attendance and to collect feedback related to the quality of the materials, the performance of the speakers, and the overall execution of the activity. The feedback obtained functioned as an essential evaluation component and as one of the requirements for participants to receive certificates

1.2. Phase 2 (Pre-Test and Post-Test Results)

Evaluation Stage	Average Score (%)
Pre-Test	65%
Post-Test	85%

Table 2. Average Pre-Test and Post-Test Results

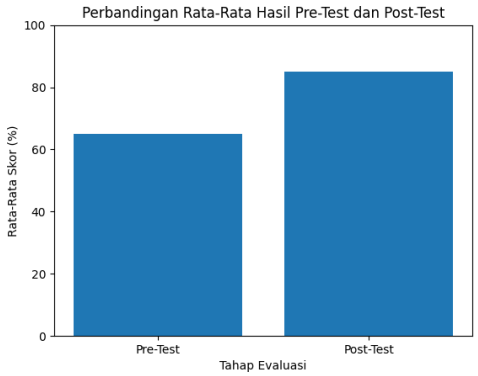

Figure 2. Comparison of the Average Pre-Test and Post-Test Results

The pre-test results indicate that participants' initial understanding was at a moderate level, with an average score of 65%. After participating in the webinar and workshop activities, a significant improvement was observed in the post-test results, with the average score increasing to 85%. This improvement demonstrates that the materials delivered and the learning methods applied were effective in enhancing participants' understanding of the concept of Codeless Data Science using the KNIME Analytics Platform.

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1.3. Phase 3 (Learning Material via Webinar)

In this phase, the webinar session was led by the speaker, Maulana Faiz, who delivered material on the fundamental concepts of Data Science and an introduction to using the KNIME Analytics Platform as a codeless data analysis tool. The material was designed in a gradual and systematic manner to ensure accessibility for participants from various backgrounds, particularly beginners with no prior coding experience.

The presentation began with an explanation of the urgency of data literacy in the digital era and the strategic role of Data Science in both academic and industrial sectors. Participants were introduced to the concept of Codeless Data Science, which enables data analysis processes through drag-and-drop techniques using visual nodes and workflow orchestration. Furthermore, the general Data Science workflow was presented, covering stages such as Data Collection, Data Understanding, Data Cleaning, Data Exploration (EDA), Modeling, Evaluation, and deriving Insights & Decisions.

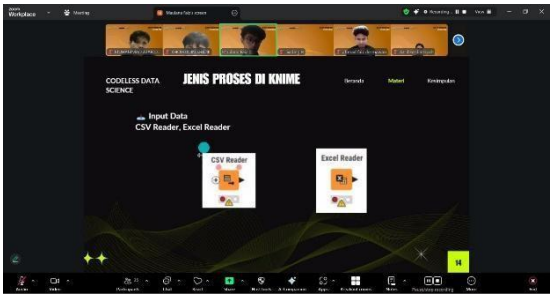

Figure 3. Webinar Presentation

Subsequently, participants were given an in-depth introduction to the KNIME Analytics Platform interface, starting from the Welcome page and the process of creating a new project (Create a new workflow), to the use of the Nodes panel for data processing. The session also emphasized the use of intelligent support features such as the KNIME AI Assistant (K-AI) and the Workflow Monitor to facilitate real-time logic development. Through this session, participants were expected to understand that the complexity of the data science lifecycle can now be accessed inclusively and practically, without the barriers of complex programming languages.

In Figure 2 above, the presenter explains the initial stage of the data science workflow, specifically the Input Data process. The slide introduces participants to the functional nodes used to import raw data into the KNIME platform, such as the CSV Reader and Excel Reader, demonstrating how data can be easily integrated without manual coding.

1.4. Phase 4 (Implementation through Workshop)

In this interactive workshop session, Ahmad Faiz Dermawan directly guided participants through a demonstration of basic nodes in the KNIME Analytics Platform. The demonstration began with an introduction to data reader nodes for local files, followed by detailed and practical data retrieval from Google Drive, enabling participants to easily understand the integration of external data sources.

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Next, the presenter proceeded with a descriptive analysis of Superstore sales results, utilizing the Superstore Sales dataset downloaded from Kaggle. The entire process was conducted using drag-and-drop methods, allowing participants to intuitively visualize data without writing code.

Upon completing this section, Ahmad Faiz Dermawan demonstrated predictive modeling using the Decision Tree algorithm to forecast student graduation outcomes, based on a student graduation dataset also sourced from Kaggle. The demonstration encompassed the complete workflow, starting from data acquisition, data preprocessing to clean and prepare the dataset, exploratory data analysis (EDA) to identify patterns, Decision Tree modeling, and evaluation of prediction results to measure model accuracy. This provided participants with a comprehensive understanding of codeless Data Science workflows.

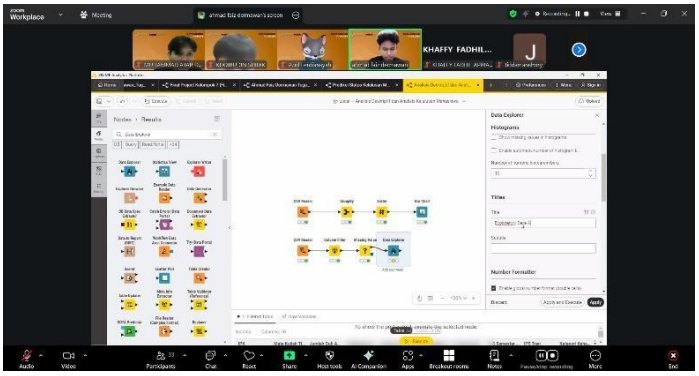

Figure 4. Workshop Presentation

In Figure 3, the presenter demonstrates the preprocessing of the student graduation dataset using the Column Filter and Missing Value nodes, prior to proceeding to the exploratory data analysis (EDA) stage with the Data Explorer node.

The primary benefits of this session were that participants gained practical skills in code-free data analysis, enhanced their data literacy, and acquired the ability to apply KNIME to real-world projects in academic and industrial contexts, through an accessible approach suitable even for beginners.

1. Activity Evaluation and Feedback

Aspect	Main Participants' Suggestions
Activity Duration	Extending the workshop duration to allow more optimal hands-on practice
Materials	Adding case studies and real-world data examples
Technical Implementation	Delivering the materials in a more gradual manner to accommodate beginners
Learning Media	Providing session recordings and supporting learning modules

Table 3. Summary of Participants' Suggestions and Feedback

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Based on the evaluation results, participants' satisfaction with the webinar and workshop activities demonstrated a very positive response. More than 90% of the participants were categorized as satisfied and very satisfied, indicating that the materials, delivery methods, and overall implementation of the activities were aligned with participants'needs. Nevertheless, several suggestions highlighted opportunities for improvement, particularly regarding the duration of the activities and the depth of hands-on practice. Overall, these evaluation results confirm that the community engagement activities were conducted effectively and were well received by the participants.

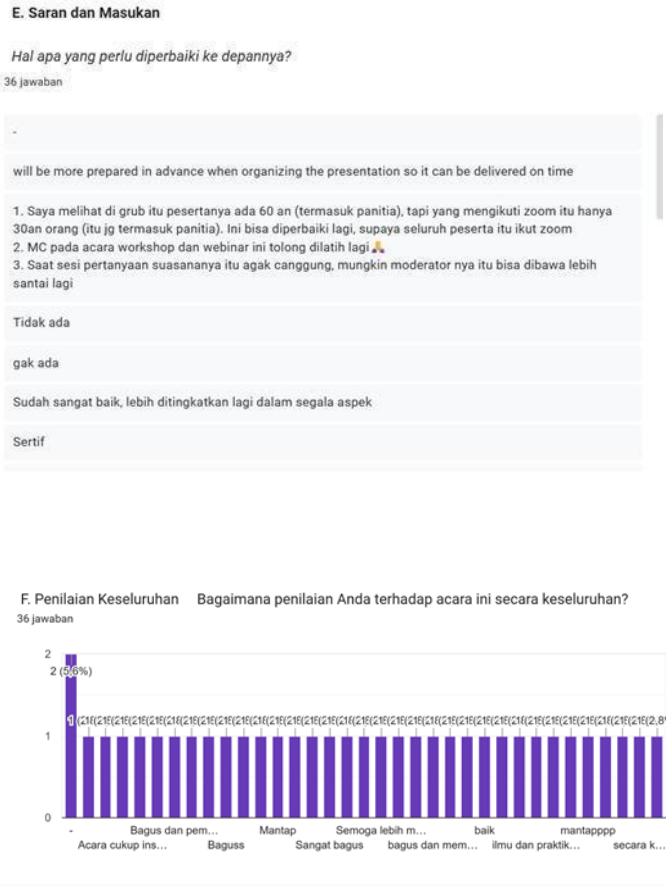

Figure 5. Overall Evaluation

Based on Figure 50 (Overall Evaluation), the majority of participants more than 90% of respondents provided a positive evaluation of the event overall. This is evident from the dominance of responses in the good, very good, and excellent categories, indicating that the activities conducted were well received by the participants.

D. CONCLUSION

The community engagement program conducted through a webinar and workshop entitled *"Codeless Data Science Using KNIME: Data Analysis and Optimization without Coding"* was successfully implemented and achieved its intended objectives. The application of a codeless approach proved effective in enhancing participants' understanding of fundamental data science concepts without requiring programming

skills.

The evaluation results show a significant improvement in participants' knowledge, as indicated by the increase in the average score from 65% in the pre-test to 85% in the post-test, representing a 20% improvement. In addition, participant feedback demonstrated very positive responses, with more than 90% of participants reporting satisfaction and high satisfaction with the learning materials, delivery methods, and overall implementation of the program. Despite certain limitations related to time constraints and variations in participants' initial knowledge levels, the findings confirm that codeless data science learning using the KNIME Analytics Platform is an inclusive, effective, and practical approach for enhancing community data literacy in the digital era.

E. ACKNOWLEDGEMENTS

The authors and team would like to thank Information Technology Study Program, University of Muhammadiyah Jakarta, Fakultas of Engineering, for their support in the implementation of this community engagement program. The authors also express their gratitude to all participants who actively joined the webinar and workshop entitled "Codeless Data Science Using KNIME: Data Analysis and Optimization without Coding".

F. AUTHOR CONTRIBUTIONS

Activity Implementation: Ahmad Faiz Dermawan, Muhammad Ajar Danu Wiratama, Maulana Faiz, Khoirudin Sidik, Azril Ferdiansyah Romadoni. Material Delivery: Maulana Faiz, Workshop Execution: Ahmad Faiz Dermawan, Document Preparation: Muhammad Ajar Danu Wiratama, Ahmad Faiz Dermawan, Mirza Sutrisno, Manuscript Writing & Revision: Nurvelly Rosanti, Yana Adharani, Rully Mujiastuti, Mirza Sutrisno.

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