

Enhancing Educational Practices through AI and Data Visualization: Insights from a Community Engagement Workshop

Melissa Indah Fianty^{1*}, Fahmy Rinanda Saputri²

^{1,2} Universitas Multimedia Nusantara, Tangerang, Banten, Indonesia

*Corresponding author: melissa.indah@umn.ac.id

Received 16-07-2024

Revised 20-07-2024

Accepted 26-07-2024

ABSTRAK

Pengabdian ini mengeksplorasi penerapan kecerdasan buatan (AI) dan visualisasi data dalam konteks pendidikan melalui workshop interaktif. Workshop ini bertujuan untuk meningkatkan kapasitas guru SMA di Jakarta dalam menerapkan teknologi untuk analisis data menggunakan aplikasi seperti Tableau. Peserta terlibat dalam praktik langsung dengan empat studi kasus: analisis performa siswa berdasarkan gender, pengaruh pendidikan orang tua terhadap kinerja siswa, evaluasi efektivitas kursus persiapan ujian, dan analisis pengaruh program makan siang terhadap prestasi siswa. Hasilnya menunjukkan peningkatan signifikan dalam pemahaman dan keterampilan peserta dalam menggunakan data untuk mendukung pengambilan keputusan yang berbasis bukti di lingkungan pendidikan.

Kata kunci: Artificial Intelligence (AI), Visualisasi Data, Tableau, Analisis Data, Pengabdian Masyarakat

ABSTRACT

This community engagement explores the application of Artificial Intelligence (AI) and data visualization in the context of education through an interactive workshop. The workshop aims to enhance the capacity of high school teachers in Jakarta to utilize technology for data analysis using applications like Tableau. Participants engage in hands-on practice with four case studies: analysis of student performance by gender, the influence of parental education on student outcomes, evaluation of the effectiveness of exam preparation courses, and analysis of the impact of lunch programs on student achievement. Results indicate a significant improvement in participants' understanding and skills in using data to support evidence-based decision-making in educational settings.

Keywords: Artificial Intelligence (AI), Data Visualization, Tableau, Data Analysis, Community Engagement

INTRODUCTION

The rapid development of information technology in this digital era has brought significant impacts on various aspects of life, including the field of education. One of the technological advancements that can be utilized in education is Artificial Intelligence (AI). The use of AI in the learning process can assist teachers in finding, creating, and using teaching materials more effectively and efficiently (Fianty et al., 2024). Additionally, with data visualization technology, teachers can analyze student performance more deeply and accurately (MZ et al., 2022a). In this context, using tools like Tableau becomes very relevant for data visualization and dashboards (Purich et al., 2023).

Tableau is a powerful and intuitive data visualization tool that allows users to create interactive and informative charts, dashboards, and reports. With its user-friendly drag-and-drop interface, Tableau enables users from various backgrounds, including those without deep technical knowledge, to easily analyze and understand their data (Zikri et al., 2017). The tool supports integration with various data sources and offers a wide range of visualizations, such as bar charts, pie charts, maps, and more, facilitating data exploration from multiple perspectives (Rolansa, 2021). In the context of education, Tableau can help teachers visualize student performance, analyze academic trends, and make more informed decisions based on data (Sharma & Deshmukh, 2020).

In the community service activity, a workshop is conducted for high school teachers in Jakarta with the topic of utilizing AI in the learning process and practicing creating visualizations and dashboards using Tableau. This workshop aims to enhance teachers' competencies in utilizing the latest technology to support teaching and learning activities. With a dataset called "Students Performance," the workshop covers four main topics relevant to analyzing student performance.

The first case to be discussed is the analysis of student performance based on gender. Teachers are often interested in knowing whether there are significant differences in academic performance between male and female students. Therefore, the dashboard to be created will display bar charts comparing the average scores in mathematics, reading, and writing between male and female students. With this visualization, teachers can easily see the trends and patterns present. The results of this analysis can help teachers determine more appropriate teaching strategies. If significant differences in academic performance based on gender are found, teachers can adjust their teaching methods to ensure that every student, both male and female, has an equal opportunity to succeed. For example, if female students tend to have lower scores in mathematics, teachers can implement more inclusive and supportive teaching approaches to improve their performance.

The second case to be discussed is the impact of parental education on student performance. In many studies, the level of parental education is often linked to the academic outcomes of their children. Teachers want to understand how the level of parental education influences student test scores. Therefore, data visualizations such as pie charts or bar charts comparing the average scores of students based on their parents' education levels will be created. By understanding the correlation between parental education and student academic performance, teachers can provide additional support to students whose parents have lower education levels. This could include extra tutoring, motivation, or more intensive learning resources. In this way, any performance gaps can be minimized, and every student has an equal chance to reach their full potential.

The third case is the evaluation of the effectiveness of exam preparation courses on student test results. Many schools offer exam preparation courses to help students better prepare. However, it is important to evaluate whether these courses actually have a positive impact on student performance. The dashboard to be created will display comparison charts of the average scores in mathematics, reading, and writing between students who attended the exam preparation courses and those who did not. The results of this analysis will provide insights for teachers and school administrators about the effectiveness of existing exam preparation programs. If it is proven that exam preparation courses have a significant positive impact, the school can decide to continue or even enhance the program. Conversely, if there is no significant difference, a review of the course methods and materials might be necessary.

The final case to be discussed is the analysis of the impact of lunch programs on student achievement. Teachers want to know whether there is a relationship between the type of lunch program students receive (standard or free/reduced) and their academic performance. The dashboard will display bar charts or pie charts comparing the average scores of students based on the type of lunch program they receive (Sihombing et al., 2019). By examining this data, teachers can evaluate whether students receiving free or reduced-price lunches have different academic performance compared to those who pay for lunch. If significant differences are found, necessary actions can be taken to support students who may need additional assistance. For example, more nutritious lunch programs or additional academic support programs could be implemented to help improve student performance.

This workshop not only aims to improve teachers' technical competencies in using AI and Tableau but also to equip them with strong data analysis skills. With a better understanding of how various factors influence student performance, teachers can make more informed and strategic decisions to improve learning outcomes (Daffa Rafrisah & Informasi, n.d.). Ultimately, the main goal of this activity is to support efforts to improve the quality of education in Indonesia, particularly for high school teachers (MZ et al., 2022b). With more skilled and data-driven teachers, it is hoped to create a better and more inclusive learning environment for all students. By utilizing the right technology, schools can more effectively face the challenges of education in this digital era. Through this community service activity, it is expected to make a tangible contribution to creating a better and more equitable education system, and this activity can become a model for other teacher professional development programs in the future.

METHODS

The workshop, scheduled for Tuesday, July 9, 2024, at Computer Lab C706, Universitas Multimedia Nusantara, will be conducted by Melissa Indah Fianty, S.Kom., MMSI, a lecturer in the Information Systems program with a focus on big data. As the facilitator, participants, consisting of high school teachers from Jakarta, will be guided through sessions on AI's application in education and practical Tableau visualization

exercises. This initiative aims to empower educators with tools and knowledge to integrate advanced technologies into their teaching methodologies effectively (Kurniawan Hidayat, 2023) (Sutedjo & Jaya Perdana, 2023). The workshop include interactive discussions, hands-on practice, and collaborative dashboard creation sessions, fostering a dynamic learning environment that encourages exploration and application of innovative educational practices.



Figure 1. Program Implementation Methods

The description of the community service program activities is as follows:

1. Preparation

Preparation is done in coordination with the schools: the Marketing team from Universitas Multimedia Nusantara holds initial meetings with representatives from schools in Jakarta to explain the objectives and benefits of the workshop, as well as to identify the schools' needs and expectations. Preparation of workshop materials includes basic theory on AI in education, introduction to Tableau, and the "Students Performance" dataset. Procurement of necessary equipment such as computer labs/laptops with Tableau software installed, projectors, and a stable internet connection.

2. Registration and Announcement

Registration or teachers from one of the high schools in Jakarta who are interested in attending the workshop, and announcement and socialization of the workshop schedule and details to registered participants via email or WhatsApp groups.

3. Workshop Implementation

The workshop begins with an opening, including a welcome speech by a university representative and a brief explanation of the workshop's objectives and agenda.

a. Session 1: Introduction to AI in Education

- Theory Material: Explanation of basic AI concepts and how this technology can be applied in the learning process.
- Discussion: Interactive discussion on experiences and challenges in using technology in the classroom.

b. Session 2: Introduction to Tableau

- Basic Tutorial: Demonstration of basic Tableau usage, including how to import data, create charts, and build dashboards.
- Practical Exercise: Participants try to create simple visualizations using the "Students Performance" dataset.

c. Session 3: Case Studies and Discussion

- Performance Analysis Based on Gender: Guidance on creating a dashboard to analyze academic performance differences between male and female students.
- Influence of Parents' Education: Creating visualizations to understand the impact of parents' education level on student performance.
- Effectiveness of Test Preparation Courses: Evaluation of test preparation courses through data visualization.
- Analysis of Lunch Programs: Creating charts to see the impact of lunch programs on student performance.

d. Session 4: Dashboard Creation and Presentation

- Dashboard Creation: Participants work in groups to create comprehensive dashboards based on one of the case studies.
- Presentation and Feedback: Each group presents their work and receives feedback from the speakers and other participants.

4. Discussion and Recommendations

After the presentations, an open discussion is held about the findings and insights obtained from the created dashboards. Strategy Recommendations: The speakers and participants formulate learning strategy recommendations based on the data analysis results. Follow-Up Plan: Develop a follow-up plan to implement the recommended learning strategies and monitor their impact.

5. Evaluation and Documentation

- a. Activity Evaluation: Conduct an evaluation session to gather feedback from participants about the workshop's execution and materials provided.

- b. Report Creation: Prepare a report on the workshop, including its proceedings, discussions, and recommendations.
- c. Activity Documentation: Collect and store documentation in the form of photos, videos, and notes from the entire workshop series.

RESULTS AND ANALYSIS

In an effort to enhance teachers' skills in using technology, Universitas Multimedia Nusantara organized a workshop. Engaging 13 high school teachers from Jakarta, the event focused on leveraging AI for educational processes and honing skills in Tableau for data visualization. Throughout the day, participants delved into the theoretical foundations of AI in education, explored practical Tableau demonstrations, and applied their knowledge with real-world datasets like "Students Performance." In this interactive session, educators actively created and analyzed dashboards to assess student performance based on various factors such as gender, parental education levels, and lunch programs. Discussions revolved around interpreting data insights to tailor teaching strategies effectively. By the workshop's conclusion, participants gained proficiency in integrating AI tools and Tableau visualizations into their teaching methodologies, equipped with new strategies to foster personalized learning environments and enhance educational outcomes for their students.

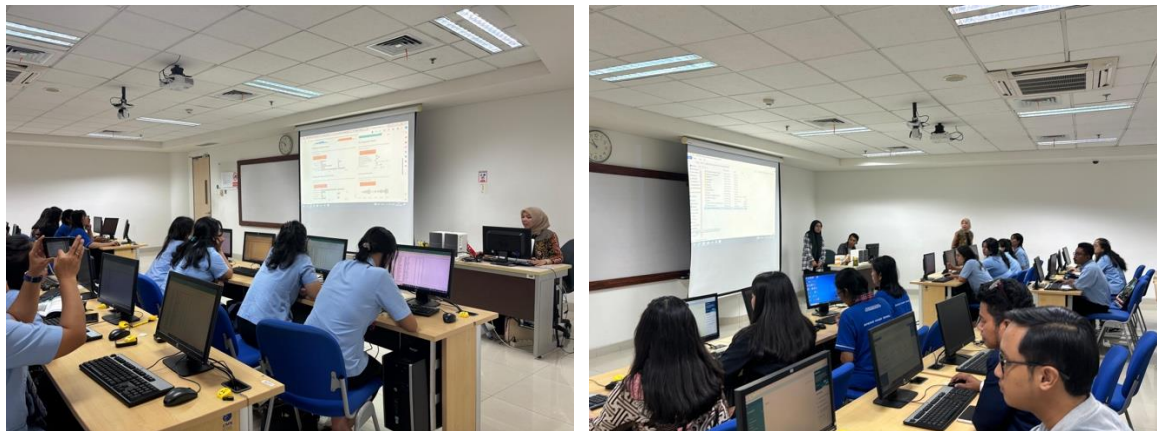


Figure 2. Implementation of Training Activities

In Figure 2 of the workshop documentation, the workshop presenter is captured in an interactive session discussing Artificial Intelligence (AI) and its implications in education. The photograph portrays the presenter, positioned as the workshop leader, engaging in an animated discussion with the participants. The setting is within Lab Computer C706 at Universitas Multimedia Nusantara, where the workshop took place on July 9, 2024. The workshop leader, an expert in the field of Information Systems with a specialization in Big Data, leads the discussion, covering topics such as the fundamentals of AI, its impact on education, and practical strategies for teachers to integrate AI into the classrooms.



Figure 3. The workshop topics and subtopics

During the workshop session, Figure 3 illustrates the topics and subtopics discussed in class, focusing on the intricacies of Artificial Intelligence (AI) and emphasizing its transformative potential in educational settings. The discussion centered on how AI technologies can augment teaching methodologies by enabling personalized learning experiences and adaptive assessments. Participants gained insights into AI applications that facilitate data-driven decision-making, enhancing educational outcomes through tailored interventions and real-time feedback mechanisms. Practical examples of AI in education, such as AI-powered tutoring systems and adaptive learning platforms, were highlighted to illustrate how these technologies can cater to diverse learning needs and improve student engagement and performance.

Furthermore, the session explored the broader impact of AI on educational practices, addressing the evolving role of educators in leveraging AI tools effectively. The presenter underscored the importance of educators embracing AI as a supportive tool rather than a replacement for traditional teaching methods. Discussions revolved around strategies for integrating AI-driven insights into classroom practices, empowering teachers to utilize data analytics to identify learning gaps, personalize instruction, and track student progress more effectively. By embracing AI technologies responsibly, educators can foster a more dynamic and inclusive learning environment, equipping students with essential skills for the digital age while ensuring equitable access to quality education for all learners.

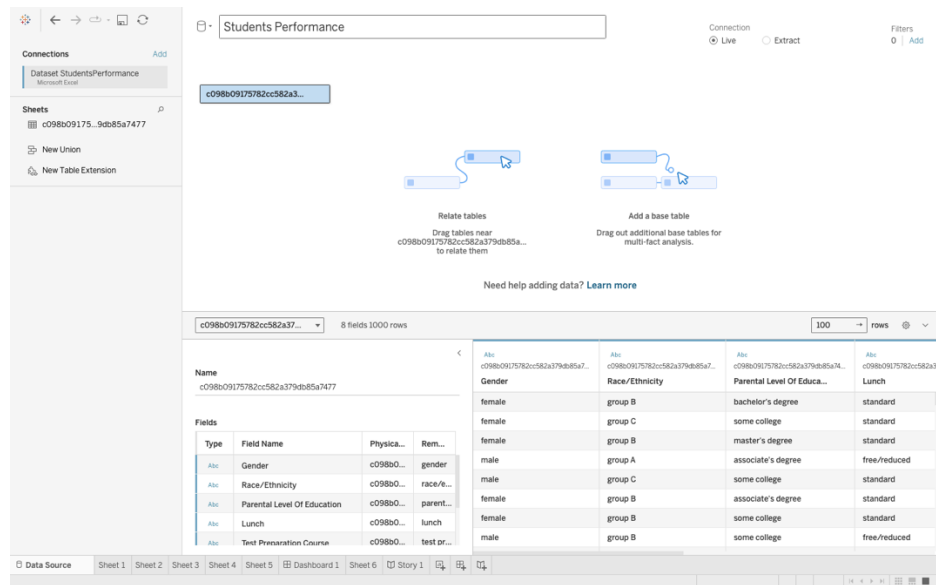


Figure 4. Import dataset into the Tableau application

After the presentation session on artificial intelligence (AI) and its impact in education, the workshop proceeded with the use of Tableau application in figure 4. Participants prepared their computers and opened the Tableau application along with the prepared dataset, "Students Performance". Before practical exercises began, the presenter introduced four case studies that needed to be completed using Tableau to generate data visualizations.

These four case studies included analysis of student performance based on gender, the influence of parental education on student performance, evaluation of the effectiveness of exam preparation courses, and analysis of the impact of lunch programs on student achievement. Each case study was designed to provide a comprehensive understanding of how to use Tableau for data analysis and visualization, aiming to support more informed decision-making in educational settings.

To begin with, importing datasets into Tableau is the initial step in creating data visualizations for the case studies mentioned. Once the datasets, such as the "Students Performance" dataset, are imported into Tableau, users can start visualizing the data. Tableau allows users to connect to various data sources seamlessly and import datasets with ease. After importing, users can manipulate and transform the data using Tableau's intuitive interface. For each case study—such as analyzing student performance by gender, the impact of parental education on student performance, the effectiveness of exam preparation courses, and the analysis of the lunch program's influence on student achievement—visualizations are created to provide insights and facilitate informed decision-making in educational contexts.

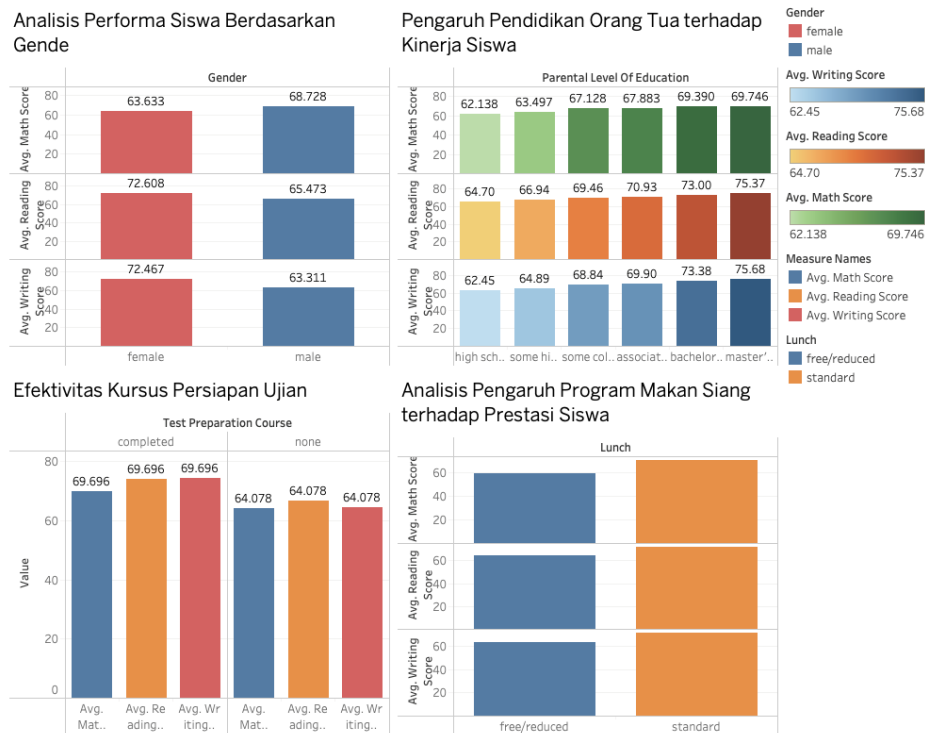


Figure 5. Dashboards from the 4 data visualizations

Figure 5, the workshop produced 4 distinct dashboards utilizing Tableau, each focusing on different aspects of student performance analysis. The first dashboard examined the performance disparities between male and female students across mathematics, reading, and writing subjects. The second dashboard delved into the correlation between parental education levels and student academic outcomes, highlighting any potential influences. The third dashboard evaluated the effectiveness of exam preparation courses by comparing the academic scores of students who participated in these courses versus those who did not. Lastly, the fourth dashboard analyzed the impact of lunch program types (standard, free/discounted) on student achievement, aiming to identify any disparities in academic performance based on the type of lunch program received. These dashboards provided comprehensive visual insights into various educational metrics, enabling educators to make informed decisions to enhance student learning outcomes.

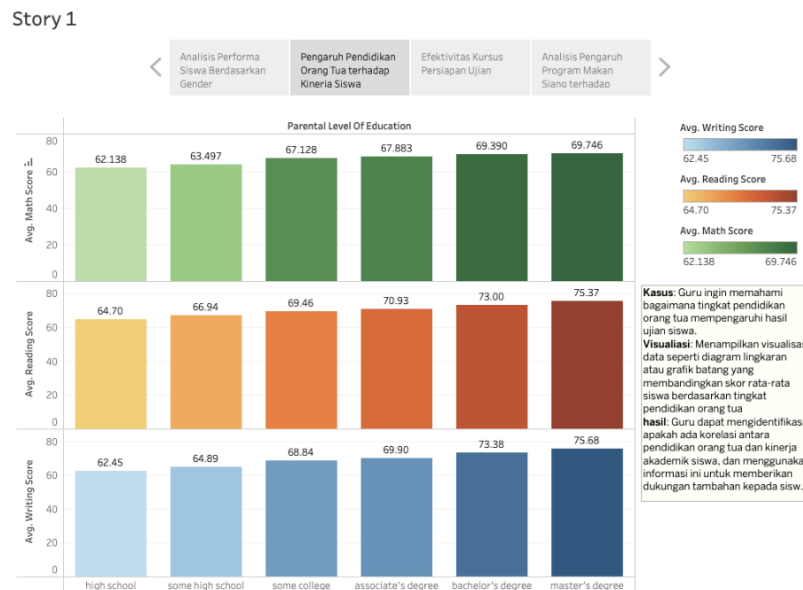


Figure 6. Story visualization of data in Tableau

Figure 6, the story dashboard in Tableau allows for the presentation of a series of visualizations and insights in a coherent narrative flow. It enables users to combine multiple dashboards and worksheets into a single interactive experience, guiding viewers through a structured storyline or analysis. Each dashboard or visualization within the story can highlight different aspects of the data, presenting key findings, trends, or comparisons effectively. This approach not only enhances data comprehension but also facilitates decision-making by presenting data-driven insights in a logical sequence. Story dashboards in Tableau are particularly useful for workshops and presentations as they provide a structured way to communicate complex data analyses and findings to stakeholders, helping them grasp the significance of the information presented and its implications for educational strategies and policies.



Figure 7. Photo session with the presenter and participants

After creating data analysis, data visualization, dashboards, and dashboard stories, the final session is a Q&A and evaluation session highlighting the importance of using data visualization for teachers in schools. The Q&A session provides participants with an opportunity to delve into the application of the presented analysis, while the evaluation aims to gather feedback on the relevance and usefulness of the materials learned in their teaching contexts. Participation in this session not only strengthens understanding of data visualization techniques but also helps prepare teachers to plan its use to enhance classroom teaching and learning. Thus, this workshop not only provides technical skills but also promotes the development of more informative and effective approaches in managing and utilizing data in educational settings.

At the end of the session, Figure 7 captured a group photo to commemorate the successful completion of the workshop. This moment captured the camaraderie and collaborative spirit among the participants and the presenter, symbolizing their shared commitment to advancing educational practices through data visualization. The photo serves as a memorable reminder of the valuable insights gained and the relationships forged during the workshop.

CONCLUSION

Based on the community service workshop conducted, it is evident that integrating AI and data visualization tools like Tableau into education empowers teachers with enhanced analytical capabilities. The workshop not only equipped participants with technical skills but also fostered a deeper understanding of leveraging data for informed decision-making in educational settings. Through practical exercises and case studies, educators gained proficiency in creating meaningful visualizations that can effectively track student performance, analyze educational trends, and tailor teaching strategies.

Furthermore, the collaborative environment during the workshop underscored the importance of continuous professional development in adapting to technological advancements in education. The feedback received highlighted the enthusiasm among teachers to implement these newfound skills in their classrooms, aiming to improve learning outcomes and ensure equitable educational opportunities for all students. Overall, this community service initiative not only addressed current educational challenges but also laid the groundwork for ongoing support and capacity building among educators in integrating AI and data visualization effectively into their teaching practices.

ACKNOWLEDGMENT

The successful implementation of this Community Service Program is attributed to the assistance and backing received from Multimedia Nusantara

University. Gratitude is extended for the aid and support extended throughout the course of this endeavour.

REFERENCES

- Daffa Rafrisah, F., & Informasi, S. (n.d.). Information Visualization Application Design By Descriptive Statistical Method. *Jurnal Teknik Informatika Dan Sistem Informasi*, 10(1). <http://jurnal.mdp.ac.id>
- Fianty, M. I., Shabrina, N. H., & Saputri, F. R. (2024). Project-Based Learning Training for Teachers at Madrasah Aliyah Raudhlatul Irfan, Lengkong Kulon Village. *I-Com: Indonesian Community Journal*, 4(1), 145–157. <https://doi.org/10.33379/icom.v4i1.3922>
- Kurniawan Hidayat, M. (2023). Perancangan Dashboard Untuk Visualisasi Data Jumlah Penumpang Transjakarta. In *Sains Teknik Elektro* (Vol. 4, Issue 1). <http://jurnal.bsi.ac.id/index.php/insantek32>
- MZ, Y., Bororing, J. E., Rahayu, S., & Ramadhani, T. A. (2022a). Aplikasi Dashboard Visualisasi Data Calon Mahasiswa Baru menggunakan Metabase. *Edumatic: Jurnal Pendidikan Informatika*, 6(1), 116–125. <https://doi.org/10.29408/edumatic.v6i1.5483>
- MZ, Y., Bororing, J. E., Rahayu, S., & Ramadhani, T. A. (2022b). Aplikasi Dashboard Visualisasi Data Calon Mahasiswa Baru menggunakan Metabase. *Edumatic: Jurnal Pendidikan Informatika*, 6(1), 116–125. <https://doi.org/10.29408/edumatic.v6i1.5483>
- Purich, J., Srinivasan, A., Correll, M., Battle, L., Setlur, V., & Crisan, A. (2023). *Toward a Scalable Census of Dashboard Designs in the Wild: A Case Study with Tableau Public*.
- Rolansa, F. (2021). Pengembangan interaktif dashboard kemahasiswaan di program studi teknik informatika dengan teknologi big data. *Jurnal Pendidikan Informatika Dan Sains*, 10(2), 110–118. <https://doi.org/10.31571/saintek.v10i2.2190>
- Sharma, B., & Deshmukh, S. (2020). Data Visualization for Accelerated Business Intelligence in the Indian Health Care Sector using Tableau. *International Journal of Recent Technology and Engineering (IJRTE)*, 9, 304–308. <https://doi.org/10.35940/ijrte.D4979.119420>
- Sihombing, W. W., Aryadita, H., & Rusdianto³, D. S. (2019). *Perancangan Dashboard Untuk Monitoring Dan Evaluasi (Studi Kasus: FILKOM UB)* (Vol. 3, Issue 1). <http://j-ptiik.ub.ac.id>
- Sutedjo, I., & Jaya Perdana, N. (2023). *PERANCANGAN DASHBOARD PENGGUNAAN INTERNET INDONESIA*. 8(2).
- Zikri, A., Adrian, J., Soniawan, A., Azim, R., Dinur, R., & Akbar, R. (2017). Implementasi Business Intelligence untuk Menganalisis Data Persalinan Anak di Klinik Ani Padang dengan Menggunakan Aplikasi Tableau Public. *Jurnal Online Informatika*, 2, 20. <https://doi.org/10.15575/join.v2i1.70>