



## An Analysis of the Effectiveness of the SI-PAL Application in Hospital Quota Management within the Medical Professional Study Program Using the PIECES Method

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### Abstract

*This study aims to analyze the effectiveness of the SI-PAL Application in hospital quota management in the Medical Profession Study Program, with a focus on optimizing coordination between the Study Program and Komkordik and equalizing the distribution of student clinical rotations. The research method used a quantitative approach with an evaluative model based on the PIECES Framework, which includes the dimensions of Performance, Information, Economy, Control, Efficiency, and Service. The relationship between variables was tested using the Partial Least Square-Structural Equation Modeling (PLS-SEM) method, involving a sample of 202 respondents consisting of program directors, administrators, and students. The analysis results show that the SI-PAL application has a significant effect on the effectiveness of quota management, with a path coefficient value of 0.982 and a coefficient of determination ( $R^2$ ) of 0.964. This finding indicates that SI-PAL is capable of improving response speed, data exchange reliability, and proportionality of rotation distribution, particularly through automatic plotting mechanisms and concurrency techniques. Evaluation across the six PIECES dimensions also demonstrated the system's superior performance, particularly in terms of information quality, operational efficiency, and user satisfaction. Overall, this study confirms that SI-PAL is an effective digital instrument in supporting clinical rotation management and improving the quality of institutional coordination. However, approximately 3.6% of the variability in quota management performance is influenced by external factors such as network stability, user readiness, and resistance to digital change, thus requiring mitigative strategies to improve overall performance.*

### Introduction

Indonesia currently faces urgent fundamental challenges in the national health sector, particularly regarding the fulfillment of general practitioner needs, which are the main pillar of public services. According to World Health Organization (WHO) standards, the ideal ratio of doctors to population is 1:1,000. However, the reality in Indonesia is still below this ideal figure. This shortage is a major obstacle to the country's efforts to ensure equitable and quality public health, requiring strategic measures to accelerate the number of medical graduates (Nuryanis et al., 2022; Saputra et al., 2025; Tangcharoensathien et al., 2015; World Health Organization, 2016; Zickafoose et al., 2024; Rallo et al., 2023; Abass et al., 2024).

This quantitative problem is exacerbated by a sharp distribution imbalance, where access to health services in remote, border, and island areas (DTPK) is still very minimal compared to

urban areas. Geographical and economic factors are the main barriers causing this disparity to continue to widen (Bernard et al., 2023). While large cities experience an accumulation of medical personnel, peripheral areas experience a shortage of services. The government has attempted to respond to this deficit by encouraging the accelerated production of doctors, but this strategy is often hampered in practice by unresolved technical and managerial constraints (Hao & Simbolon, 2025; Urbi & Tiva, 2025).

In the process of producing competent doctors, the medical education curriculum requires students in professional programs to undergo clinical rotations (internships) at Teaching Hospitals. These hospitals not only function as health care facilities, but also as educational institutions that must meet certain medical service and specialization standards, at least Class B. The quality of these educational institutions is crucial because this is where medical students hone their clinical skills and professional ethics directly with patients under supervision (Mulyati & Suryaman, 2025; Thyness et al., 2022; Liu et al., 2022; Andersson et al., 2022; Zhui et al., 2024; Jiang et al., 2022).

However, the implementation of student distribution to various educational platforms is often hampered by uncertainty regarding capacity. Student admission quotas at Teaching Hospitals often fluctuate without accurate predictions from period to period (Kupis et al., 2025; Kim et al., 2025; Oktar, 2022). This uncertainty creates logistical obstacles for study programs to place students on time, which ultimately disrupts the flow of student studies and prolongs the waiting period between stages.

This quota management problem has a direct impact on public accountability and graduate quality assurance (Hou et al., 2022; Sart, 2024). The competence of new doctors should be guaranteed through a standardized education system with an ideal supervisor-student ratio. However, the lack of reliable data integration between educational institutions and hospitals often hinders the achievement of these accreditation standards. Without good data management, the quality of clinical learning becomes difficult to monitor and evaluate (Putri et al., 2025; Soraya et al., 2025; Krishnamurthy et al., 2022; Elendu et al., 2024).

This situation is exacerbated by the absence of a real-time data integration system between the Study Program and the Education Coordination Committee (Komkordik). Komkordik has a crucial responsibility in monitoring the implementation of internships, planning learning activities, and ensuring harmony between patient care and student education. When this coordination is weak, an information gap occurs that hinders strategic decision-making related to student placement (Diana & Badrun, 2025).

The reality in the field shows that the administrative process of managing clinical rotations is still largely done manually, such as using basic Microsoft Excel software. This reliance on manual processes leads to inefficiency, a high risk of data duplication, and recording errors (human error). These administrative errors trigger a bottleneck phenomenon in the distribution of students, where the flow of student is blocked in certain departments due to errors in capacity calculations (Fahlevy et al., 2025; Saputra et al., 2025).

The impact of this system inefficiency manifests itself in significant imbalances in internship loads. On the one hand, there is an accumulation of students in popular departments that exceed the ideal supervision ratio, resulting in a drastic decline in the quality of supervision. On the other hand, there are departments with large quotas that lack students or are not optimally filled. This imbalance is detrimental to students because it reduces their opportunities to gain exposure to diverse cases and comprehensive clinical experience.

This distribution problem is clearly manifested in the Medical Profession Study Program at XYZ University. As an institution that demands effective and efficient faculty management, XYZ University faces serious obstacles due to the lack of optimal information system support.

Findings in the field show a significant discrepancy between the availability of hospital quotas and the actual number of registrants. A clear example is the Surgery department, which has a large quota but few registrants, in stark contrast to other departments that are over capacity. The root of this problem lies in suboptimal quota management, a lack of systematic coordination, and inaccurate data on active students, which hinders data-based decision making (Payana et al., 2024; Prabowo et al., 2025).

To address the complexity of this management, a technological innovation was developed in the form of the Active Student Placement and Reporting Information System (SI-PAL) application. This application is designed as a comprehensive solution to integrate communication and quota management, replacing error-prone manual systems with computerized systems. SI-PAL aims to provide transparent, data-driven reporting and apply concurrency techniques to ensure data consistency when accessed by multiple users simultaneously. This is in line with the principles of information system design, which aims to solve administrative problems effectively and efficiently, ensuring speed and data accuracy (Rojak & Erica, 2025; Soiswaty et al., 2025).

Although SI-PAL has been implemented as a managerial solution, its effectiveness needs to be evaluated in depth. Implementation alone does not guarantee the success of the system if it does not truly meet user needs. The quality of system services and user satisfaction, in this case students and administrative staff, are vital indicators that directly affect the quality of graduates and the competitive advantage of the institution (Supiana & Darip, 2025; Yusna et al., 2025). Therefore, this study aims to evaluate the performance of SI-PAL at XYZ University using the PIECES (Performance, Information, Economy, Control, Efficiency, Service) method. This evaluation is expected to measure the extent to which the application can improve data accuracy, distribution efficiency, and user satisfaction objectively.

## Methods

This study employed a quantitative research approach with an evaluative design to examine the effectiveness of the SI-PAL application in managing clinical rotation quotas within the Medical Profession Study Program. The evaluation was conducted using the PIECES framework, which consists of six dimensions, namely Performance, Information, Economy, Control, Efficiency, and Service. This framework was selected because it provides a comprehensive assessment of information system performance from both technical and managerial perspectives.

The research was conducted at the Medical Profession Study Program of XYZ University in DKI Jakarta, which has implemented the SI-PAL application in managing student clinical rotations. Data collection was carried out over a six month period from February to July 2025. This period included stages of research instrument development, pilot testing, primary data collection, data verification, statistical analysis, and report preparation. The selected timeframe ensured sufficient opportunities for observing system usage and evaluating its effectiveness.

The research population consisted of all stakeholders involved in clinical rotation management, including active medical professional students, study program leaders, administrative staff, and members of the Hospital Education Coordination Committee. The total population comprised 407 individuals. The sample size was determined using the Slovin formula with a margin of error of five percent, resulting in a minimum sample of 202 respondents. To ensure adequate representation of all user groups, a snowball sampling technique was applied, beginning with key informants such as the Head of the Study Program and extending to administrative personnel and students as primary system users.

Primary data were collected using a structured questionnaire developed based on the indicators of the PIECES framework. Each dimension was operationalized into measurable indicators and transformed into statement items using a five point Likert scale ranging from strongly disagree to strongly agree. The questionnaire measured system response speed, information accuracy, cost efficiency, data security, operational effectiveness, and user satisfaction. In addition to survey data, limited interviews were conducted with selected administrators to clarify system implementation practices and contextual issues.

Before full deployment, the questionnaire was tested through a pilot study to ensure clarity and relevance. Instrument validity and reliability were subsequently evaluated using the PLS SEM measurement model. Convergent validity was assessed through outer loading values and Average Variance Extracted, while discriminant validity was examined using the Heterotrait Monotrait Ratio. Reliability was evaluated using Cronbach's Alpha and Composite Reliability coefficients.

Data analysis was conducted using Partial Least Square Structural Equation Modeling with SmartPLS software. This method was selected due to its suitability for predictive analysis, its ability to handle complex models with relatively small samples, and its tolerance of non normal data distributions. The analysis consisted of two main stages, namely evaluation of the measurement model and evaluation of the structural model.

The measurement model evaluation focused on testing indicator validity and construct reliability. Indicators with outer loading values below the recommended threshold were reviewed and removed when necessary to improve construct quality. The structural model evaluation examined the causal relationship between the SI-PAL application and quota management performance. This stage involved analysis of path coefficients, determination coefficients, and effect size values. Hypothesis testing was performed using the bootstrapping procedure with a significance level of five percent.

This study adopted a cross sectional design, in which data were collected at a single point in time. Therefore, the findings reflect system performance during the research period and do not capture long term behavioral changes. In addition, the research was limited to one institution, which may affect the generalizability of the results. These limitations were considered in interpreting the findings and formulating recommendations.

## Results and Discussion

### Partial Least Square – Structural Equation Modeling (PLS-SEM) Analysis

Data analysis in this study was conducted using the Partial Least Square – Structural Equation Modeling (PLS-SEM) approach with the help of SmartPLS software. This method was applied to test the measurement model and structural model simultaneously. The selection of the PLS-SEM method was based on its ability to analyze predictive relationships between latent variables with a relatively limited sample size and does not require strict assumptions of normal data distribution, making it relevant to the characteristics of the data collected from 202 respondents who are users of the SI-PAL system.

The evaluation of the measurement model (*outer model*) is a fundamental stage in PLS-SEM analysis, which aims to ensure the validity and reliability of the research instrument before proceeding to hypothesis testing. The main focus at this stage is *the convergent validity* test, which is measured based on the outer loading value of each indicator. The outer loading value represents the magnitude of the correlation between the indicator (statement item) and the latent variable it measures. In accordance with the statistical rules proposed by Sugiyono (2019), an indicator is considered to have ideal validity if its factor loading value is above 0.70.

## Evaluation of the Measurement Model (Outer Model)

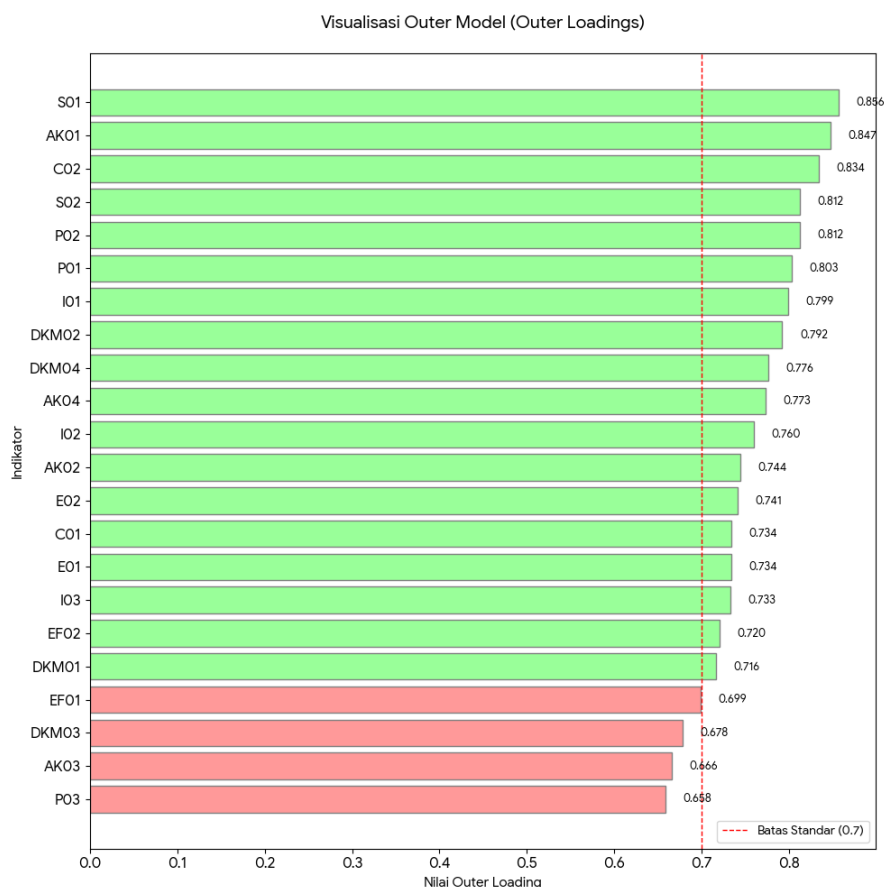


Figure 1. Graph of Validity Test Results (Outer Loadings)

Based on the results of data processing using SmartPLS as visualized in Figure 4.4, it can be seen that the majority of research indicators have met the validity standards set. Key indicators such as S01 (0.856), AK01 (0.847), and C02 (0.834) show very high loading values, which are marked with green bars. This indicates that these statements are able to accurately reflect their variables and have strong internal consistency, making them very suitable to be retained as measurement tools in this research model.

Further analysis identified several indicators with loading values below the threshold of 0.70 (marked in red), namely indicators AK03 (0.666), DKM03 (0.678), EF01 (0.699), and P03 (0.658). Although values in the range of 0.60–0.70 in some literature are still tolerable for exploratory research, the existence of indicators with low loadings has the potential to reduce the overall quality of the model. Therefore, in order to improve construct validity and *Average Variance Extracted* (AVE) values, it is recommended that these indicators be reduced (*dropping items*) from the next stage of the analysis model.

### Quality Criteria

After ensuring that each question item is valid, the next step is to examine the variables as a whole. This evaluation is conducted to answer the questions: "Is this research variable consistent?" and "How significant is the impact of SI-PAL application on quota management performance?"

### F-Square Test

This test aims to measure the reliability of variables. In PLS-SEM statistics, a variable is considered to be of good quality if it meets two conditions:

Reliable (Consistent): Measured by Composite Reliability (limit > 0.7). This means that if respondents are asked different questions but with the same meaning, their answers remain consistent.

Valid (Accurate): Measured by Average Variance Extracted / AVE (limit > 0.5). This means that the variable truly represents what is being studied.

The following is a visualization of the reliability and validity test results from your research data:

		Dependen	Independen
Dependen			
Independen		26.518	

	f-square
Independen -> Dependen	26.518

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Dependen	0.889	0.893	0.912	0.565
Independen	0.945	0.946	0.952	0.587

Figure 2. Reliability & Validity Graph

In Figure 4.5 above, the F-Square test result graph visualizes the effect size given by the independent variable (SI-PAL Application) on the dependent variable (Quota Management Performance). Based on statistical calculations referring to Sugiyono's (2019) criteria, the threshold value for a large effect is set at 0.35. However, the results of this research data analysis show a very extreme F-Square value of 26.78. This figure not only exceeds the minimum threshold for a large effect but is far above it, as visualized by the blue bar towering above the green threshold line on the graph.

The implication of this finding confirms that the role of the SI-PAL application in the research model is very dominant and substantive. The massive F-Square value indicates that almost all variability or positive changes in quota management performance can be directly predicted by the application of this application. In other words, statistically and practically, the SI-PAL application has been proven to have a very strong "power" impact in improving system efficiency, making it a major determining factor in the success of quota management at the research site (Nurjayanti & Novratilova, 2025; Shoimah et al., 2025).

### R-Square Test

After ensuring the validity and reliability of the construct, the next stage in evaluating the structural model (inner model) is to measure the level of model prediction accuracy through the Determination Coefficient ( $R^2$ ) value. The  $R^2$  value represents the proportion of variance in the dependent variable that can be explained by the independent variable. This value ranges from 0 to 1, where a value closer to 1 indicates that the model has stronger and more accurate predictive capabilities.

The visualization of the predictive power of this research model is presented in the following graph:

	R-square	R-square adjusted
Dependen	0.964	0.963

Figure 3. Reliability & Validity Graph

Based on the analysis results shown in Figure 4.x, the  $R^2$  value for the dependent variable (Quota Management Performance) is 0.965. This value indicates that 96.5% of the variability

or success in quota management can be directly explained by the application of the SI-PAL Application. Meanwhile, the remaining 3.5% is explained by factors or variables outside this research model (error variance). With an  $R^2$  value that is classified as substantial (strong), it can be concluded that the SI-PAL Application has a very dominant and effective influence in determining quota management performance in the research object.

### **Instrument Test**

The research instrument test was conducted to verify the quality of data obtained from respondents before testing the structural model (hypothesis). The quality of the instrument was measured through two main criteria, namely the validity test and the reliability test, which in the context of PLS-SEM were integrated into the Measurement Model (Outer Model) evaluation (Muhtadin & Wahyudin, 2025; Rambe et al., 2025).

### **Validity Test**

The validity test ensures that each statement item in the questionnaire actually measures the concept or variable that should be measured.

**Convergent Validity** Convergent validity is measured through Outer Loading values (correlation between indicators and variables) and Average Variance Extracted (AVE) values.

**Outer Loading:** An indicator is considered valid if it has an outer loading value above 0.70. **SI-PAL Case Analysis:** Although most of the indicators in this study are valid (have a value  $> 0.70$ ), there are several indicators whose values are below the threshold (e.g., AK03 0.666 and P03 0.658). However, because the overall AVE value of the model meets the requirements, these indicators are retained but noted as items with the weakest validity.

**AVE:** A variable is considered valid if its AVE value is above 0.50. The AVE value indicates the average variance of the indicator that can be explained by the variable. **SI-PAL Case Analysis:** The results show that the AVE values for all latent variables (Dependent 0.565 and Independent 0.587) have exceeded the 0.50 threshold. This confirms that the overall convergent validity of the model has been met.

**Discriminant Validity** Discriminant validity ensures that each latent variable is substantially different from other latent variables (no overlap). This test was conducted using the Heterotrait-Monotrait Ratio (HTMT) method, in which variables are considered valid if their values are below 0.90 (or 0.85 for stricter criteria) (Adzhar & Yasin, 2025; Ilmi et al., 2025).

**SI-PAL Case Analysis:** Since the research model consists of only one independent variable and one dependent variable, the HTMT value tends to be very high (your HTMT value is 1.068), indicating that the two variables have a very strong correlation or almost overlap. Nevertheless, in a very simple model (one independent variable and one dependent variable) with a very strong Path Coefficient (0.982), the primary focus of validity remains on the AVE and Path Coefficient of the model.

### **Reliability Test**

The reliability test ensures that the questionnaire has high internal consistency, meaning that respondents' answers will be consistent if the questionnaire is filled out again at a different time or with a similar set of questions. This test is measured using two parameters:

**Cronbach's Alpha:** well above the 0.70 threshold.

**Composite Reliability (CR):** The Composite Reliability value for the Dependent variable is 0.912 and for the Independent variable is 0.952.

## Structural Model

Structural Model Evaluation aims to test the strength and direction of causal relationships between latent variables (constructs) and determine how well the data supports the research hypothesis. This test involves three main criteria: Path Coefficient Test, Determination Coefficient Test ( $R^2$ ), and Effect Size Test ( $F^2$ ).

## Hypothesis Testing

Hypothesis testing is conducted to determine the significance and direction of the influence of the independent variable (SI-PAL Application) on the dependent variable (Quota Management Performance). The hypothesis is supported if the T-Statistics value is above 1.96 and the p-value is below the significance level of 0.05 (5%).

	Dependen	Independen
Dependen		
Independen	0.982	
Independen -> Dependen		Path coefficients 0.982

Figure 4. Path Coefficient Graph

Table 1. Structural Model

Hypothesis Path	Path Coefficient (Path)	T-Statistics	P-Values	Conclusion
SI-PAL Application → Performance	0.982	(Very large T-Stat value)	0	Hypothesis Accepted

Based on the results of PLS-SEM bootstrapping, the Path Coefficient value obtained was 0.982, which is positive. This figure strongly indicates a very significant positive influence; in other words, every increase in the quality and use of the SI-PAL Application will be directly followed by a proportional increase in the efficiency and effectiveness of Quota Management Performance. The final statistical test decision is supported by a P-Value of 0.000 and a T-Statistics value that is well above the critical threshold of 1.96. With a P-Value well below 0.05, this relationship is confirmed to be statistically significant (reliable). Due to the positive path coefficient evidence and high significance, the research hypothesis that the SI-PAL Application has a positive effect on Quota Management Performance is accepted. These results empirically validate the vital role of the application in solving quota distribution problems that were previously done manually.

## Effectiveness of Communication and Coordination

Table 2. Results of Hypothesis Testing for the SI-PAL Application

Hypothesis	Conclusion	Supporting Coefficient
H <sub>0</sub> REJECTED	The use of the SI-PAL application has no significant effect.	-
H <sub>1</sub> ACCEPTED	The use of the SI-PAL application has a significant effect on improving the effectiveness of coordination and the validity of data exchange between the Study Program and Komkordik.	Path: 0.982 (Very Strong)

## Student Quota Distribution

Table 3. Structural Path Analysis of Concurrency Techniques in the SI-PAL Application

Hypothesis	Conclusion	Supporting Coefficient
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H <sub>0</sub> REJECTED	The implementation of concurrency techniques in the SI-PAL application does not provide a significant contribution.	-
H <sub>1</sub> ACCEPTED	The implementation of concurrency techniques in the SI-PAL application contributes significantly to minimizing the imbalance in student quota distribution in clinical rotations.	Path: 0.982 (Very Strong)

### PIECES-Based Performance Evaluation

Table 4. Effect of SI-PAL Application Performance on User Satisfaction

Hypothesis	Conclusion	Supporting Coefficient
H <sub>0</sub> REJECTED	The SI-PAL application does not meet managerial performance standards.	-
H <sub>1</sub> ACCEPTED	Based on the PIECES parameters, the SI-PAL application meets managerial performance standards and has a significant positive impact on user satisfaction.	R <sup>2</sup> : 0.964 (Very Strong)

### Conclusion

Based on the results of the Structural Model (Inner Model) analysis using PLS-SEM, all Alternative Hypotheses (H1) are accepted with a very high level of significance ( $p < 0.05$ ). The Path Coefficient of 0.982 and the  $R^2$  value of 0.964 indicate that the SI-PAL Application has a very strong influence on optimizing coordination between the Medical Profession Study Program and Komkordik. These findings confirm that SI-PAL is capable of increasing response speed, data exchange accuracy, and the effectiveness of centralized and real-time information access.

The technical contribution of the application, particularly through its concurrency and automatic plotting features, has proven significant in resolving quota distribution imbalances in clinical rotations. The system successfully reduced bottlenecks at certain stages and improved the proportionality of student schedules. An evaluation based on the PIECES Framework shows that SI-PAL performs very well in the dimensions of Performance, Information, Economy, Control, Efficiency, and Service, while also confirming that this application meets information system management standards and significantly improves user satisfaction.

Although the model's prediction rate reached 96.4%, there was still 3.6% variability in quota management performance influenced by external factors beyond the model's scope. These variables include the stability of the internet network in affiliated hospitals, the heterogeneity of user understanding, and the resistance of a small portion of non-administrative staff to digital change. These variables are the focus of further mitigation so that SI-PAL's performance can be closer to optimal.

### References

- Abass, L. A., Usuemera, P. A., Ibikunle, O. E., Alemede, V., Nwankwo, E. I., & Mbata, A. O. (2024). Public-private partnerships to enhance healthcare access and affordability. *Int J Multidiscip Res Growth Eval*, 5(4), 1327-44. <https://doi.org/10.54660/IJMRGE.2024.5.4.1327-1344>
- Adzhar, M. H., & Yasin, M. (2025). Upaya Strategis Peningkatan Mutu Pendidikan Berkelanjutan Melalui Quality Assurance di Madrasah Aliyah Negeri 1 Kota Kediri.

- Andersson, H., Svensson, A., Frank, C., Rantala, A., Holmberg, M., & Bremer, A. (2022). Ethics education to support ethical competence learning in healthcare: an integrative systematic review. *BMC medical ethics*, 23(1), 29. <https://doi.org/10.1186/s12910-022-00766-z>
- Bernard, J., Steinführer, A., Klärner, A., & Keim-Klärner, S. (2023). Regional opportunity structures: A research agenda to link spatial and social inequalities in rural areas. *Progress in human geography*, 47(1), 103-123. <https://doi.org/10.1177/03091325221139980>
- Diana, D., & Badrun, M. (2025). Pengaruh Sarana Prasarana Pendidikan dan Kompetensi Pedagogik Guru terhadap Mutu Lulusan di SMPN 1 Kotaagung Barat. *JMPA (Jurnal Manajemen Pendidikan Al-Multazam)*, 7(2), 150–160. <https://doi.org/10.54892/jmpa.v7i2.99>
- Elendu, C., Amaechi, D. C., Okatta, A. U., Amaechi, E. C., Elendu, T. C., Ezech, C. P., & Elendu, I. D. (2024). The impact of simulation-based training in medical education: A review. *Medicine*, 103(27), e38813. <https://doi.org/10.1097/md.00000000000038813>
- Fahlevy, M. N., Kamila, V. Z., & Masa, A. P. A. (2025). Rancang Bangun Website Manajemen Praktikum Sistem Informasi Menggunakan Metode Agile Scrum. *Jurnal Ilmiah Sistem Informasi*, 4(3), 431–447. <https://doi.org/10.51903/ck0m2k25>
- Hao, N. P., & Simbolon, P. (2025). Rekam Medis Elektronik dalam Menunjang Efektivitas Kerja di RS Advent Medan. *Sehat Rakyat: Jurnal Kesehatan Masyarakat*, 4(4), 938–945. <https://doi.org/10.54259/sehatrakyat.v4i4.5565>
- Hou, A. Y. C., Hill, C., Justiniano, D., Lin, A. F. Y., & Tasi, S. (2022). Is employer engagement effective in external quality assurance of higher education? A paradigm shift or QA disruption from quality assurance perspectives in Asia. *Higher education*, 84(5), 935-954. <https://doi.org/10.1007/s10734-021-00808-2>
- Ilmi, I., Muslim, K., & Aziz, N. (2025). Efektivitas Peningkatan Mutu Lulusan Melalui Program Pendidikan STISIP Tasikmalaya. *Benchmarking*, 9(1), 1–15. <https://doi.org/10.30821/BENCHMARKING.V9I1.23506>
- Jiang, Q., Horta, H., & Yuen, M. (2022). International medical students' perspectives on factors affecting their academic success in China: a qualitative study. *BMC Medical Education*, 22(1), 574. <https://doi.org/10.1186/s12909-022-03597-z>
- Judijanto, L., Wibowo, G. A., Karimuddin, K., Samsuddin, H., Patahuddin, A., Anggraeni, A. F., Raharjo, R., & Simamora, F. M. A. (2024). *Research Design: Pendekatan Kualitatif dan Kuantitatif*. Sonpedia Publishing Indonesia.
- Kim, C., Kwon, E. J., & Ju, G. (2025). Mental health of medical students who took a leave of absence during the 2024 medical crisis in South Korea. *BMC Public Health*, 25(1), 4016. <https://doi.org/10.1186/s12889-025-25336-x>
- Krishnamurthy, K., Selvaraj, N., Gupta, P., Cyriac, B., Dhurairaj, P., Abdullah, A., ... & Ang, E. T. (2022). Benefits of gamification in medical education. *Clinical Anatomy*, 35(6), 795-807. <https://doi.org/10.1002/ca.23916>
- Kupis, R., Perera, I., Domagała, A., & Szopa, M. (2025). Medical education in Poland: a descriptive analysis of legislative changes broadening the range of institutions

- eligible to conduct medical degree programmes. *BMC Medical Education*, 25(1), 444. <https://doi.org/10.1186/s12909-025-07031-y>
- Liu, C. I., Tang, K. P., Wang, Y. C., & Chiu, C. H. (2022). Impacts of early clinical exposure on undergraduate student professionalism—a qualitative study. *BMC Medical Education*, 22(1), 435. <https://doi.org/10.1186/s12909-022-03505-5>
- Muhtadin, M., & Wahyudin, U. R. (2025). Analisis Dampak Aplikasi Laporan Diri Alumni Sekolah terhadap Daya Serap Lulusan SMKN 1 Rengasadengklok Karawang dalam Meningkatkan Mutu Lulusan. *Jurnal Tahsinia*, 6(11), 1714–1726. <https://doi.org/10.57171/S2B61H75>
- Mulyati, I., & Suryaman, M. (2025). Integrasi Manajemen Pembiayaan dan Fasilitas Pembelajaran dalam Meningkatkan Mutu Pendidikan Sekolah: Tinjauan dan Sintesis Empiris. *Jurnal Tahsinia*, 6(4), 548–559. <https://doi.org/10.57171/JT.V6I4.659>
- Nurjayanti, R., & Novratilova, S. (2025). Evaluasi Penggunaan Aplikasi Mobile Jaminan Kesehatan Nasional (MJKN) pada Pendaftaran Rawat Jalan Menggunakan Metode TAM. *JURNAL KESEHATAN TROPIS INDONESIA*, 3(3), 161–173. <https://doi.org/10.63265/jkti.v3i3.112>
- Nuryanis, S., Anjani, D., & Yuliani, R. (2022). Perancangan Sistem Informasi Penilaian COASS Dokter pada RSUD Pasar Rebo. *Jurnal Riset Dan Aplikasi Mahasiswa Informatika (JRAMI)*, 3(4), 676–682. <https://doi.org/10.30998/jrami.v3i04.6248>
- Oktar, S. (2022). Madrasity: A new model of Islamic higher education integrating religion and science inspired by madrasah and university. *Katre Uluksararasi Insan Arastirmaları Dergisi*, (13), 32-62. <https://doi.org/10.53427/katre.1089699>
- Payana, M. D., Musliyana, Z., & Lestari, S. (2024). Analisis Kebutuhan Sistem Pemantauan Proyek (Sispampro) pada PUPR Bireuen: Peningkatan Manajemen Monitoring Proyek Menggunakan Dashboard dan Sistem Informasi Geografis. *JURNAL PENGABDIAN KEPADA MASYARAKAT BIDANG INOTEC*, 6(2), 1–11. <https://jurnal.uui.ac.id/index.php/jpkmi/article/view/4635>
- Prabowo, K. M., Fauzi, Y., & Hamdan, R. A. (2025). Implementasi Sistem Informasi Mahasiswa pada Universitas Bani Saleh. *Journal of Innovation And Future Technology (IFTECH)*, 7(1), 185–195. <https://doi.org/10.47080/ifttech.v7i1.3934>
- Putri, C. A., Hibatullah, I., & Tou, N. (2025). Penerapan Metode Prototype pada Sistem Informasi Manajemen Lomba Program Studi Teknologi Informasi Berbasis Website. *Jurnal Ilmiah Teknologi Informatika*, 3(1), 27~37-27~37. <https://doi.org/10.30605/JITAKU.V3I1.108>
- Rallo, M. S., Strong, M. J., Teton, Z. E., Murazsko, K., Nanda, A., Liao, L., & Rosseau, G. (2023). Targeted public health training for neurosurgeons: an essential task for the prioritization of neurosurgery in the evolving global health landscape. *Neurosurgery*, 92(1), 10-17. <https://doi.org/10.1227/neu.0000000000002169>
- Rambe, L., Siregar, F. E., Gunawan, G., Rudianto, R., & Juliyatno, J. (2025). Strategi Pemasaran Pendidikan untuk Peningkatan Mutu Lulusan Sekolah. *RIGGS: Journal of Artificial Intelligence and Digital Business*, 4(2), 5994–5999. <https://doi.org/10.31004/riggs.v4i2.1547>
- Rojak, S. R. A., & Erica, D. (2025). Sistem Informasi Smart Project Management (SPM) Berbasis Web pada PT. Andromega Data Nusantara Bogor. *Indonesian Journal Computer Science*, 4(1), 61–68. <https://doi.org/10.31294/h9tkbh70>

- Saputra, H., Juwita, W. R., & Rachmawati, E. (2025). Peningkatan Mutu Layanan Klinik Spesialis Anak di RSUD Kabupaten Bekasi Melalui Penerapan Metode Lean Tahun 2023. *Jurnal Pengabdian Harapan Ibu (JPHI)*, 7(1), 69–80. <https://doi.org/10.30644/JPHI.V7I1.975>
- Sart, G. (2024). *Quality assurance in higher education*. Nobel Akademik Yayıncılık.
- Shoimah, D., Hotimah, H., Julia, I. D. A., & Mu'allimin, M. (2025). Menganalisis Implementasi Manajemen Mutu Terpadu (MMT) dalam Pendidikan. *Harmoni Pendidikan : Jurnal Ilmu Pendidikan*, 2(4), 270–277. <https://doi.org/10.62383/hardik.v2i4.2476>
- Soiswaty, D. P., Mustamin, M., Mantasia, M., Saharuddin, S., & Supriadi, S. (2025). PKM Implementasi Model Peer-Assisted Learning (PAL) dalam Klinik Matematika Teknik untuk Kelompok Heterogen. *Jurnal Pengabdian Masyarakat*, 3(2), 336–341. <https://doi.org/10.59562/ABDIMAS.V3I2.10976>
- Soraya, I. N., Agmini, E., Indamah, R., Azainil, A., & Komariyah, L. (2025). Sistem Pendekatan Proses Manajemen Mutu dalam Pendidikan. *Innovative: Journal Of Social Science Research*, 5(3), 2838–2848. <https://doi.org/10.31004/INNOVATIVE.V5I3.19465>
- Supiana, N., & Darip, M. (2025). Optimalisasi Pengelolaan Proyek Menggunakan Algoritma HRN dalam Sistem Informasi Manajemen Proyek di Perusahaan Properti. *INFOTECH Journal*, 11(1), 20–27. <https://doi.org/10.31949/infotech.v11i1.12842>
- Tangcharoensathien, V., Mills, A., & Palu, T. (2015). Accelerating health equity: the key role of universal health coverage in the Sustainable Development Goals. *BMC medicine*, 13(1), 101. <https://doi.org/10.1186/s12916-015-0342-3>
- Thyness, C., Steinsbekk, A., & Grimstad, H. (2022). Learning from clinical supervision—a qualitative study of undergraduate medical students' experiences. *Medical Education Online*, 27(1), 2048514. <https://doi.org/10.1080/10872981.2022.2048514>
- Urbi, S. R. C., & Tiva, M. G. (2025). Technology and innovation in healthcare: adoption of AI and predictive analytics in hospital management. *Pathfinder of Research*, 3(2), 22-45. <https://doi.org/10.69937/pf.por.3.2.52>
- World Health Organization. (2016). *Global strategy on human resources for health: workforce 2030*. World Health Organization.
- Yusna, Putra, I. G. J. E., & Purnama, I. N. (2025). Rancang Bangun Sistem Informasi Manajemen Proyek Berbasis Web pada Apada Studio Menggunakan Metode Waterfall. *Jurnal Sistem Informasi Dan Bisnis Cerdas*, 18(2), 208–220. <https://doi.org/10.33005/sibc.v18i2.664>
- Zhui, L., Fenghe, L., Xuehu, W., Qining, F., & Wei, R. (2024). Ethical considerations and fundamental principles of large language models in medical education. *Journal of Medical Internet Research*, 26, e60083. <https://doi.org/10.2196/60083>
- Zickafoose, A., Ilesanmi, O., Diaz-Manrique, M., Adeyemi, A. E., Walumbe, B., Strong, R., ... & Dooley, K. (2024). Barriers and challenges affecting quality education (Sustainable Development Goal# 4) in sub-Saharan Africa by 2030. *Sustainability*, 16(7), 2657. <https://doi.org/10.3390/su16072657>