E-ISSN : 2828-0903
P-ISSN : 2827-9077
IJESS | INDONESIAN JOURNAL OF EDUCATION AND SOCIAL STUDIES

Indonesian Journal of Education and Social Studies (IJESS)
Vol. 05, No. 02 (2026), p. 204-218
Available online at https://ejournal.unuja.ac.id/index.php/IJESS

Educational Management and Data Governance: Bridging the Competency Gap Among Students and Academic Staff in Higher Education

Raiyan Bin Reza[1]*, Rinku Rani Shell[2]
[1]East West University Dhaka, Bangladesh
[2]Government Primary School Lakshmipur, Bangladesh

*Corresponding Author: raiyanb.reza@ewubd.edu
http://doi.org/10.33650/ijess.v5i2.13240
Received: 11 November 2025, Revised: 18 August 2026, Accepted: 01 September 2026

Abstract:

This study examines data literacy competencies among students and faculty members by assessing their awareness, knowledge, access to data literacy programs, and proficiency across key data-related competency domains. This study used a quantitative cross-sectional survey design, collecting data from 205 respondents through a structured questionnaire measured on a five-point Likert scale. Descriptive statistics identified patterns of data literacy, while the Kruskal–Wallis test examined differences across demographic characteristics and levels of core data literacy knowledge. The findings indicate that 81.0% of respondents recognized data literacy as important, 77.1% reported familiarity with data literacy concepts, and 52.7% demonstrated knowledge of core data literacy skills. However, 60.5% indicated limited access to data literacy programs. Significant differences were identified across gender, age, and core data literacy knowledge. Competency levels were relatively stronger in data ethics, evaluation, and visualization but lower in data gateways and GIS analysis. These findings highlight the need for comprehensive, inclusive data literacy education strategies that integrate technical, analytical, evaluative, and ethical competencies into higher education curricula and professional development programs to strengthen institutional readiness and support lifelong learning in 21st-century digital environments.

Key Words: *Data Literacy, Higher Education, Data Competencies, Digital Education*

Please cite this article in APA style as:

Reza, R. B., & Shell, R. R. (2026). Educational Management and Data Governance: Bridging the Competency Gap Among Students and Academic Staff in Higher Education. *Indonesian Journal of Education and Social Studies*, *5*(2), 204-218.

INTRODUCTION

Data have become a critical resource shaping modern society by influencing communication, employment, education, healthcare, governance, and decision-making processes (George & George, 2024; Mujtaba, 2025). The growing integration of digital technologies has led to massive data generation, requiring individuals not only to access information but also to understand,

evaluate, and apply it responsibly. Data literacy is therefore essential because it enables individuals to recognize relevant information (Andini et al., 2025; Isnaningsih et al., 2026; Pamuji & Iliasu, 2026), assess data credibility, interpret meanings, and communicate evidence-based conclusions (Ologbosere, 2023; Wang & Liu, 2025; Mosia et al., 2025). This capability is increasingly important because inaccurate data interpretation can affect personal decisions, professional practice, and societal outcomes. Evidence from various sectors shows that responsible data use supports better planning, innovation, and problem-solving. Therefore, strengthening data literacy is necessary to support informed participation in a data-driven society (Fitria, 2024; Maisuroh et al., 2024; Manarbek et al., 2024; Surendran et al., 2024; Nasrullah et al., 2025; Putri et al., 2026).

Within higher education, data literacy has become an essential academic capability because universities increasingly rely on data for teaching, learning evaluation, research activities, institutional planning, and strategic decision-making. Students and faculty members regularly interact with datasets, statistical outputs, digital platforms, and research findings that require critical interpretation and appropriate application. Data literacy extends beyond technical analysis because it involves understanding data sources, evaluating reliability, interpreting patterns, and communicating findings ethically (Kim et al., 2024; Echtenbruck et al., 2025; Rea et al., 2021). Previous evidence indicates that academic communities with stronger data competencies are better prepared to engage in evidence-based practices and respond to complex information environments. Consequently, universities have an important role in developing data-literate communities through educational programs, curriculum integration, and professional development initiatives (Manarbek et al., 2024; Šalamon et al., 2024).

Despite the increasing availability of digital information, access to data does not automatically ensure effective use. Many individuals, including students and faculty members, struggle to assess data quality, interpret analytical results, select appropriate information, and apply evidence in decision-making. These limitations may lead to misunderstanding, inaccurate conclusions, weak research practices, and dependence on external expertise for data interpretation (Chomunorwa & Van Den Berg, 2026; Liu et al., 2025). The challenge becomes more complex because data differ in format, accuracy, context, and purpose, requiring multidimensional competencies rather than simple technical skills. Although universities provide extensive access to digital resources, insufficient data literacy development may prevent academic communities from fully leveraging them. Therefore, understanding existing competencies and challenges is necessary to design effective institutional strategies (Ologbosere, 2023; Farr et al., 2021).

Previous studies have demonstrated that data literacy is a multidimensional competency involving data identification, collection,

management, analysis, interpretation, evaluation, and communication. Existing research has examined data literacy through various perspectives, including statistical literacy, information literacy, digital competence, and quantitative reasoning (Pinto et al., 2023; Šalamon et al., 2024; Kennedy & Gupta, 2025; Abdullah, 2025; Fahriansyah et al., 2025; Putra & Soma, 2025). These studies provide important foundations for understanding data literacy's role in educational environments. However, much of the existing literature has focused on specific skills, individual groups, or conceptual frameworks rather than examining comprehensive data literacy competencies among different members of the same university community. Furthermore, few studies have explored students and faculty members simultaneously within an integrated framework. Addressing this limitation is important because universities require shared data competencies across academic, research, and administrative activities (Echtenbruck et al., 2025; Kim et al., 2025).

Although previous research has highlighted the importance of data literacy, further investigation is required to understand how competency levels vary across academic roles, demographic characteristics, and specific data-related domains. Students and faculty members may experience different challenges because students primarily engage with data through coursework, assignments, and research projects. In contrast, faculty members frequently use data for teaching evaluation, scientific research, publication, and institutional decision-making. Previous studies have provided valuable insights but have not sufficiently addressed data literacy as an institutional capability involving diverse academic stakeholders (Chomunorwa & Van Den Berg, 2026; Galih et al., 2023; Cesna et al., 2026). Therefore, this study contributes a novel perspective by assessing multiple data literacy domains among students and faculty members within a shared analytical framework. This approach provides empirical evidence to support targeted educational strategies and sustainable institutional data practices (Fühles-Ubach et al., 2026; Taş, 2023).

This study addresses whether students and faculty members have sufficient data literacy competencies and what challenges affect their effective use of data in university contexts. This study argues that data literacy is a comprehensive academic capability rather than merely a technical skill, as effective data use requires integrating analytical, evaluative, ethical, and communication competencies. Individuals with stronger data literacy are expected to demonstrate greater capacity to interpret evidence, evaluate information quality, conduct research, and support informed decision-making. Conversely, limited competencies may restrict the effective utilization of data resources and hinder evidence-based academic practices. By identifying competency levels and associated challenges, this study aims to provide evidence for curriculum development, professional training, and institutional policies that strengthen data literacy as a core capability in higher education.

RESEARCH METHODS

This study used a quantitative, cross-sectional survey design to assess data literacy competencies among faculty members and students. The cross-sectional design was selected because it enables data collection at a single point in time, providing a systematic description of current data literacy competencies and allowing comparisons across selected demographic and academic characteristics. This approach aligns with recent data literacy research emphasizing empirical assessment of competencies in higher education contexts (Kim et al., 2024; Kim et al., 2025). The study was conducted at the University of Dhaka, selected because it provides a diverse academic environment with students and faculty who regularly engage with data through learning, teaching, research, assessment, and other academic activities. The population consisted of faculty members and students at the University of Dhaka. A total of 205 respondents participated in the study. The sample comprised 56.1% male and 43.9% female participants, with 73.2% students and 26.8% faculty members.

Data were collected using a structured questionnaire developed through a review of relevant literature and consultation with data literacy experts to ensure the instrument reflected the competencies examined in the study. The questionnaire employed a five-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree" to measure respondents' perceived data literacy competencies. The instrument covered ten domains: database skills, data formatting, metadata management, data gateways, GPS, data interpretation, data evaluation, data visualization, data citation, and data ethics. This selection of multidimensional domains aligns with recent data literacy frameworks that conceptualize data literacy as a combination of technical, analytical, evaluative, and ethical competencies (Echtenbruck et al., 2025; Pinto et al., 2023). Kim et al. (2024) and Qiao et al. (2024) also demonstrate the relevance of structured assessment instruments for measuring data literacy among higher-education populations. Participants indicated their level of agreement with statements representing each domain.

The collected data were analyzed using descriptive and inferential statistics. Descriptive analysis calculated frequencies, percentages, means, and standard deviations to summarize respondents' characteristics and provide an overview of their data literacy competencies across the measured domains. Inferential analysis employed the Kruskal–Wallis test to examine whether statistically significant differences existed in data literacy competencies across gender, affiliation, age groups, and levels of knowledge of core data literacy skills. The findings are consistent with recent research emphasizing the importance of examining variation in data literacy competencies across higher-education populations (Kim et al., 2025; Lund et al., 2026). The Kruskal–Wallis test was selected as a non-parametric alternative for comparing distributions across groups because the primary measurements used an ordinal five-point

Likert scale. The significance level was established at 0.05. The results were subsequently interpreted to identify patterns of competency and potential areas of difficulty that could inform the development of data literacy support and educational initiatives within the university.

RESULTS AND DISCUSSION

Results

A total of 205 respondents participated in the survey. As presented in Table 1, 115 respondents (56.1%) were male, and 90 (43.9%) were female. Regarding age, 137 respondents (66.8%) were aged 20–25 years, 25 (12.2%) were aged 26–31 years, 17 (8.3%) were aged 31–36 years, 10 (4.9%) were aged 37–41 years, and 13 (7.8%) were above 41 years. In terms of educational qualification, 111 respondents (54.1%) had an Honors degree, 71 (34.6%) had a Master's degree, and 23 (11.2%) had an MPhil/PhD. Based on affiliation, 150 respondents (73.2%) were students, while 55 (26.8%) were faculty members.

Table 1. Demographic Information

Category	Sub-category	Total (N)	Percentage (%)
Gender	Male	115	56.10%
	Female	90	43.90%
Age Group	20–25	137	66.8%
	26–31	25	12.2%
	31–36	17	8.3%
	37–41	10	4.9%
	Above 41	13	7.8%
Educational Qualification	Honors	111	54.1%
	Masters	71	34.6%
	MPhil/PhD	23	11.2%
Affiliation	Student	150	73.2%
	Faculty	55	26.8%

Table 2 presents respondents' responses regarding general awareness of data literacy. A total of 81.0% of respondents indicated that data literacy is important, while 16.1% expressed uncertainty regarding its importance. Regarding knowledge of data literacy, 77.1% reported knowing the concept, whereas 22.9% reported not having such knowledge. Regarding awareness of core data literacy skills, 52.7% reported being aware of these skills, while 47.3% reported not being aware of them. Furthermore, 75.6% of respondents agreed or strongly agreed that data literacy should be incorporated into the curriculum, while 5.3% disagreed or strongly disagreed. Regarding access to data literacy programs, 60.5% reported that such programs were not available to them, compared with 39.5% who reported that they were available. Finally, 98.0% of respondents indicated the importance of collaboration in data literacy.

Table 2. Respondents' Awareness and Perceptions of Data Literacy

Data Literacy Aspect	Percentage (%)
Considered data literacy important	81.0%
Uncertain about the importance of data literacy	16.1%
Reported knowledge of data literacy	77.1%
Reported lack of knowledge of data literacy	22.9%
Aware of core data literacy skills	52.7%
Not aware of core data literacy skills	47.3%
Supported inclusion of data literacy in the curriculum	75.6%
Disagreed with inclusion of data literacy in the curriculum	5.3%
Data literacy programs not accessible	60.5%
Data literacy programs accessible	39.5%
Considered collaboration important for data literacy	98.0%

Table 3 presents the descriptive statistics for the data literacy competencies. The mean scores ranged from 2.26 to 3.32, while the standard deviations ranged from 1.05 to 1.30. The highest mean score was recorded for ethical use of data (M = 3.32, SD = 1.30), followed by data evaluation (M = 3.04, SD = 1.21). Statistics and data citation both had a mean score of 2.89, with standard deviations of 1.20 and 1.27, respectively. Data visualization had a mean of 2.87 (SD = 1.25), while data preservation had a mean of 2.83 (SD = 1.20). Data interpretation had a mean of 2.81 (SD = 1.26), and data formats had a mean of 2.72 (SD = 1.10). Database skills had a mean of 2.67 (SD = 1.09), followed by metadata (M = 2.62, SD = 1.14) and GPS (M = 2.54, SD = 1.15). GIS analysis had a mean of 2.31 (SD = 1.15), while data gateways recorded the lowest mean score (M = 2.26, SD = 1.05).

Table 3. Descriptive Statistics of Data Literacy Skills

Skills	Mean	SD
Database	2.67	1.09
Data formats	2.72	1.10
Metadata	2.62	1.14
Data gateways	2.26	1.05
GPS	2.54	1.15
GIS analysis	2.31	1.15
Data interpretation	2.81	1.26
Statistics	2.89	1.20
Data evaluation	3.04	1.21
Data citation	2.89	1.27
Ethical use	3.32	1.30
Data visualization	2.87	1.25
Data preservation	2.83	1.20

Table 4 presents the Kruskal–Wallis test results examining differences in data literacy skills by gender. Statistically significant differences were identified for data formats (p = .049), metadata (p = .029), data gateways (p = .019), data interpretation (p = .002), data preservation (p = .022), data citation (p = .012),

ethical issues (p = .001), data visualization (p < .001), statistics (p < .001), and data evaluation (p = .001).

Table 4. Kruskal–Wallis Test for Data Literacy Skills and Gender

Independent Variable	Dependent Variable	p-value
Gender	Data format	.049
	Metadata	.029
	Data gateways	.019
	Data interpretation	.002
	Data preservation	.022
	Data citation	.012
	Ethical issues	.001
	Data visualization	<.001
	Statistics	<.001
	Data evaluation	.001

Table 5 shows the relationship between age and data literacy skills. Statistically significant differences were found for data format (p < .001), data interpretation (p = .007), data preservation (p = .022), data citation (p = .012), data ethics (p = .001), data visualization (p < .001), statistics (p < .001), and data evaluation (p = .001).

Table 5. Relationship Between Data Literacy Skills and Age

Independent Variable	Dependent Variable	p-value
Age	Data format	<.001
	Data interpretation	.007
	Data preservation	.022
	Data citation	.012
	Data ethics	.001
	Data visualization	<.001
	Statistics	<.001
	Data evaluation	.001

Table 6 presents the Kruskal–Wallis test results examining the relationship between knowledge of core data literacy skills and individual data-related competencies. We identified statistically significant relationships across all 13 assessed competencies. Database skills, data format, metadata, data gateways, GPS, GIS, data interpretation, data preservation, statistics, data evaluation, data visualization, data citation, and ethical issues all recorded p-values of < .001.

Table 6. Relationship Between Knowledge of Core Data Literacy Skills and Data-Related Competencies

Independent Variable	Dependent Variable	p-value
Knowledge of core data literacy skills	Database skills	<.001
	Data format	<.001
	Metadata	<.001

	Data gateways	<.001
	GPS	<.001
	GIS	<.001
	Data interpretation	<.001
	Data preservation	<.001
	Statistics	<.001
	Data evaluation	<.001
	Data visualization	<.001
	Data citation	<.001
	Ethical issues	<.001

The Kruskal–Wallis test results in Table 6 show a significant relationship between knowledge of core data literacy skills and all assessed data-related competencies, with each competency having a p-value < .001. These findings indicate that individuals with stronger foundational data literacy knowledge also tend to demonstrate higher competency across diverse data domains, including technical, analytical, evaluative, and ethical aspects. The significant associations observed in database skills, data format, metadata, and data gateways suggest that core data literacy knowledge is closely linked to the ability to manage and access data resources effectively. Similarly, the significant relationships with GPS, GIS, statistics, data interpretation, and visualization highlight the importance of foundational literacy in supporting analytical capabilities and evidence-based understanding. Furthermore, the association with data evaluation, citation, preservation, and ethical issues indicates that data literacy extends beyond technical proficiency to include responsible and critical use of information. Overall, these results emphasize that core data literacy knowledge functions as a fundamental determinant of broader data competencies, suggesting that strengthening foundational data literacy education may enhance individuals' capacity to manage, interpret, evaluate, and apply data responsibly in academic and professional contexts.

Discussion

The findings demonstrate that data literacy is widely recognized within the university community, with 81.0% of respondents identifying it as important and 77.1% reporting knowledge of data literacy. This finding aligns with recent literature that positions data literacy as an essential multidimensional competency in higher education. Kim et al. (2024) emphasize that data literacy encompasses multiple competencies required to work effectively with data, while Ologbosere (2023) highlights its growing importance in higher education. Pinto et al. (2023) further position data literacy as an important extension of information literacy. However, the present findings reveal a distinction between general awareness and deeper competency. Although awareness was relatively high, only 52.7% reported knowledge of core data literacy skills. This suggests that recognizing the importance of data literacy does not necessarily translate

into comprehensive competency, extending previous research by demonstrating this awareness–competency gap within one university community.

The descriptive results further indicate considerable variation across specific data literacy competencies. As shown in Table 3, ethical use recorded the highest mean (M = 3.32), followed by data evaluation (M = 3.04), whereas data gateways (M = 2.26) and GIS analysis (M = 2.31) recorded the lowest means. This strong emphasis on ethics aligns with contemporary data literacy frameworks that increasingly incorporate responsible data use, privacy, security, and ethical decision-making. Kim et al. (2024) identify ethical considerations as an important dimension of data literacy, while Qiao et al. (2024) incorporate data regulation and ethics within their framework for college students. Echtenbruck et al. (2025) similarly conceptualize data literacy as a multidimensional competence involving responsible engagement with data. However, the comparatively lower scores for technical competencies suggest that respondents may be more familiar with responsible data use than with specialized data infrastructures and spatial technologies. This finding adds an important competency-level distinction to existing frameworks.

The finding that 60.5% of respondents reported limited access to data literacy programs provides further evidence that institutional opportunities for competency development have not kept pace with awareness. This result corresponds with Ologbosere (2023), who highlights the continuing need to strengthen data literacy education within higher education, and Pinto et al. (2023), who emphasize the strategic importance of integrating data literacy into educational practice. The present study also supports recent competency research indicating that data literacy requires systematic development rather than isolated exposure to data concepts (Echtenbruck et al., 2025; DiMarino et al., 2023). Importantly, 75.6% of respondents supported incorporating data literacy into the curriculum, demonstrating strong demand for formal educational provision. This combination of limited program access and strong curricular support represents an institutional gap. This study therefore connects respondents' perceived need for data literacy with the availability of institutional learning opportunities, rather than examining competency independently.

The gender findings provide additional evidence that data literacy competencies are not uniformly distributed across academic populations. As reported in Table 4, significant differences were identified across ten competencies, including data format, metadata, data gateways, data interpretation, data preservation, data citation, ethical issues, visualization, statistics, and evaluation. This finding is compatible with literature showing that data literacy encompasses diverse knowledge, skills, dispositions, and behaviors rather than a single technical ability. Kim et al. (2024) conceptualize data literacy as a multidimensional construct, while Lund et al. (2026) emphasize the diverse ways data literacy is conceptualized and experienced across contexts. However,

the present study extends this perspective by empirically demonstrating that differences may occur across specific competency domains according to gender. Because the analysis does not establish causal mechanisms, these differences should not be interpreted as inherent gender-based differences. Instead, they indicate the importance of considering demographic variation when designing data literacy assessment and support within universities.

Age was also significantly associated with several data literacy competencies, as shown in Table 5. Significant relationships were identified for data format, interpretation, preservation, citation, ethics, visualization, statistics, and evaluation. These findings suggest that data literacy development may vary across stages of academic or professional experience. This is broadly compatible with research emphasizing that data literacy develops through exposure to data practices, educational experiences, and opportunities to apply data in authentic contexts (Echtenbruck et al., 2025; Lund et al., 2026). At the same time, the present results differ from approaches that treat data literacy primarily as a standardized set of technical competencies independent of context. Lund et al. (2026) similarly highlight the contextual and contested nature of data literacy. The observed age-related differences indicate that competency development may be influenced by participants' accumulated academic and professional experiences. The contribution of the present study lies in identifying age as a relevant differentiating factor across several domains while avoiding the assumption that older or younger participants are inherently more data literate.

The strongest statistical pattern emerged in the relationship between knowledge of core data literacy skills and specific competencies. As shown in Table 6, all thirteen assessed competencies demonstrated statistically significant relationships with knowledge of core data literacy skills ($p < .001$). This finding strongly supports the multidimensional conceptualization of data literacy advanced in recent research. Kim et al. (2024) identify data literacy as a multidimensional construct encompassing interconnected knowledge and skills, while Echtenbruck et al. (2025) similarly propose a competence model for higher education and research. Pinto et al. (2023) further emphasize the strategic and multidimensional nature of data literacy. The present study contributes empirical evidence that awareness of core competencies is associated with a broad range of specific data-related abilities. Its novelty lies in examining this relationship across a comprehensive set of practical competencies within the same university population, thereby demonstrating that core knowledge is not isolated from operational data skills.

Overall, this study contributes to the data literacy literature by integrating awareness, perceived competencies, demographic differences, and institutional access within a single empirical framework involving both students and faculty members. Previous studies have often focused on particular learner groups,

individual competency dimensions, or conceptual frameworks (Kim et al., 2024; Qiao et al., 2024; Khan et al., 2021; Pinto et al., 2023), whereas this study examines multiple data literacy domains simultaneously within one academic community. The findings reveal a distinctive pattern: respondents strongly recognize the importance of data literacy and ethical use, yet substantial gaps remain in core skills, technical competencies, and access to formal programs. This combination is the study's central contribution and novelty. It suggests that university data literacy should be approached not simply as individual technical training but as an institutional capability requiring curriculum integration, accessible learning opportunities, and differentiated support. The findings therefore provide an empirical basis for developing more comprehensive and context-sensitive data literacy initiatives in higher education.

CONCLUSION

This study shows that data literacy is a fundamental competency in higher education, especially as students and faculty increasingly rely on data for learning, teaching, research, academic evaluation, and evidence-based decision-making. The findings highlight that awareness of the importance of data literacy does not necessarily correspond with sufficient mastery of specific data-related competencies, indicating a critical gap between recognition and practical capability. This study advances data literacy research by providing an integrated empirical assessment of multiple competency domains within a university community and by identifying variations in data literacy levels associated with demographic characteristics and core data literacy knowledge. The results imply that higher education institutions should develop structured, inclusive, and sustainable data literacy initiatives that combine technical, analytical, evaluative, ethical, and technological competencies into curricula, training programs, and professional development frameworks. Such efforts are essential to enhance academic communities' capacity to interpret, manage, and use data responsibly in increasingly digital environments. Nevertheless, this study is limited by its cross-sectional design, reliance on self-reported measures, single-institution setting, and sample size, which constrain broader generalization and causal inference. Future research should adopt longitudinal or mixed-method approaches, involve diverse institutional contexts, and incorporate objective performance-based assessments to evaluate the effectiveness of interventions and further understand the development of data literacy competencies ov

ACKNOWLEDGMENT

The authors sincerely thank all students and faculty members who participated in this study and provided valuable responses. Appreciation is also extended to the university community and colleagues for their support, cooperation, and constructive contributions throughout the research process.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest related to the research, authorship, or publication of this manuscript.

USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY

The authors used ChatGPT as a supporting tool for language refinement, grammar checking, and improving the manuscript's clarity. The authors reviewed and verified all outputs and retained full responsibility for the research, analysis, interpretation, and final content. ChatGPT was not used to generate research data or conduct data analysis.

REFERENCES

Abdullah, A. (2025). Determinants of Teachers' Digital Literacy: The Role of Capacity Building, Career Inclusion, and Digital Platform Engagement. *Business and Applied Management Journal, 3*(1), 128–140.

Andini, V., Badri, R., Afriyanti, Y., Fadilah, N., & Aisyah, S. (2025). Improving MSME Digital Literacy through the Implementation of QRIS as a Cashless Payment Solution in the Digital Economy Era. *Communautaire: Journal of Community Service, 4*(3), 254–266. https://doi.org/10.61987/communautaire.v4i3.1336

Baimagambetova, A., Dossanova, A., Sergebaeva, A., Abdrakhmanova, A., Zhunussova, A. S., & Koishibayev, Z. (2026). The Role of Evidence-Based Data and Analytics in Medical Education Management. *Cogent Education*. https://doi.org/10.1080/2331186X.2026.2644699

Cesna, G. P., Agustiawan, S., Panjaitan, A. S., Purnama, S., & Ikhsan, R. S. (2026). Transforming Higher Education Management Through Evidence Based and Data Oriented Approaches. *Jurnal MENTARI: Manajemen, Pendidikan Dan Teknologi Informasi*. https://doi.org/10.33050/mentari.v4i2.951

Chomunorwa, S., & Van Den Berg, C. (2026). People, Data and Decisions: Overcoming Individual Barriers to Data-Driven Practice in South African Universities. *South African Journal of Information Management*. https://doi.org/10.4102/sajim.v28i1.2131

DiMarino, L., Boppana, R., Pincavage, A., Hemmer, P., Ferris, A., Chandrasekar, J., Choe, J., Dentino, A., Foster, R., Masucci, N., Ruiz Carbajal, D., Surkis, W., Acume, K.-W., O, V., & Ayyala, U. (2023). AAIM Recommendations for Undergraduate Medical Education to Graduate Medical Education Transition Curricula in Internal Medicine. *The American Journal of Medicine*. https://doi.org/10.1016/j.amjmed.2023.02.002

Echtenbruck, M., Fühles-Ubach, S., Naujoks, B., & Kaliva, E. (2025). A Data Literacy Competence Model for Higher Education and Research. *arXiv*. https://doi.org/10.48550/arXiv.2504.15690

Fahriansyah, F., Fauzan, R., & Rosnani, T. (2025). Digital Literacy and Technostress in the Job Demands-Resources Perspective: The Mediating Role of Instructional Innovation on Elementary School Teachers' Performance. *Business and Applied Management Journal, 3*(2), 327–337.

Farr, D., Zeh, H., & Abdelfattah, K. (2021). Virtual Boot Camps—An Emerging Solution to the Undergraduate Medical Education-Graduate Medical Education Transition. *JAMA Surgery*. https://doi.org/10.1001/jamasurg.2020.6162

Fitria, N. (2024). Empowering Early Childhood Educators: Innovative Approaches to Literacy Instruction. *Early Childhood Development Gazette, 1*(1), 21–30. https://doi.org/10.61987/gazette.v1i1.619

Fühles-Ubach, S., Kaliva, E., & Echtenbruck, M. (2026). Academic Libraries as Partners in Data Literacy Education—An Explorative Case Study. *Publications, 14*(1), 3. https://doi.org/10.3390/publications14010003

Galih, A. P., Barat, A., Bahar, N. Z., & Febriyanti, D. (2023). The Analysis of Data Literacy and Data Quality: Study at Faculty of Administrative Science, Brawijaya University. *Insaniyat: Journal of Islam and Humanities*. https://doi.org/10.15408/insaniyat.v8i1.29583

George, A. S., & George, A. S. H. (2024). Towards a Super Smart Society 5.0: Opportunities and Challenges of Integrating Emerging Technologies for Social Innovation. *Partners Universal International Research Journal, 3*(2), 1–29.

Isnaningsih, A., Aerin, W., Handayani, I. N., Munir, R., Ma'rifatul, U., Widi, E. K., Yuliana, V., Khotimah, A., Sindu, R., & Khudori, R. I. (2026). Empowering Communities through Ecobrick-Based Environmental Literacy for Sustainable Plastic Waste Management. *Communautaire: Journal of Community Service, 5*(1), 17–30. https://doi.org/10.61987/communautaire.v5i1.1297

Kasope, W., Elugbaju, W. K., Okeke, N. I., & Alabi, O. (2024). Conceptual Framework for Enhancing Decision-Making in Higher Education Through Data-Driven Governance. *Global Journal of Advanced Research and Reviews*. https://doi.org/10.58175/gjarr.2024.2.2.0055

Kennedy, K., & Gupta, A. (2025). AI & Data Competencies: Scaffolding Holistic AI Literacy in Higher Education. *arXiv*. https://doi.org/10.48550/arXiv.2510.24783

Khan, S., Myers, K., & DeJong, S. (2021). A National Pediatric Telepsychiatry Curriculum for Graduate Medical Education and Continuing Medical Education. *Journal of Child and Adolescent Psychopharmacology, 31*, 457–463. https://doi.org/10.1089/cap.2021.0024

Kim, J., Hong, L., & Evans, S. (2024). Toward Measuring Data Literacy for Higher Education: Developing and Validating a Data Literacy Self-Efficacy Scale. *Journal of the Association for Information Science and Technology, 75*, 916–931. https://doi.org/10.1002/asi.24934

Kim, J., Hong, L., & Yoon, A. (2025). University Students' Self-Assessment of Data Literacy: A Validation Study. *PLOS ONE, 20*. https://doi.org/10.1371/journal.pone.0322104

Liu, Q., Owen, H., & Qin, J. (2025). Reduced Information Anxiety Through Academic Library Data Literacy Education. *Proceedings of the Association for Information Science and Technology, 62*. https://doi.org/10.1002/pra2.1467

Lund, B., Hovious, A., & Kim, J. (2026). Discourses of Data Literacy: A Critical Literature Review. *Journal of the Association for Information Science and Technology*. https://doi.org/10.1002/asi.70054

Maisuroh, S., Jamil, M., & Manshur, U. (2024). The Role of Social Media in Enhancing Digital Literacy among Generation Z: A Social and Psychological Perspective. *Journal of Social Studies and Education, 2*(1), 41–53. https://doi.org/10.61987/jsse.v2i1.457

Manarbek, G., Zhaisanova, D., & Satpayeva, Z. (2024). Data-Driven Decision Making in Higher Education to Ensure Quality Education: A Bibliometric Review Study. *Bulletin of Toraighyrov University. Economics Series*. https://doi.org/10.48081/vohv9089

Mosia, M., Nannim, F., & Egara, F. (2025). Assessing Perceived Data Literacy Among First-Year University Students in South Africa. *Multidisciplinary Journal of Educational Research*. https://doi.org/10.17583/remie.16109

Mujtaba, B. G. (2025). Human-AI Intersection: Understanding the Ethical Challenges, Opportunities, and Governance Protocols for a Changing Data-Driven Digital World. *Business Ethics and Leadership, 9*(1), 109–126. https://doi.org/10.61093/bel.9(1).109-126.2025

Nasrullah, M., Hassan, D., Muhammad, D., Ullah, I., & Scholar, P. (2025). Data Literacy Competencies: A Comparison Between Applied and Social Science Students at the BS Level. *Social Science Review Archives*. https://doi.org/10.70670/sra.v3i3.963

Noor, S., Khushhal, S., Amjad, A., & Aqil, A. (2025). Using AI to Inform Evidence-Based Decision-Making in Educational Policy. *Review of Applied Management and Social Sciences*. https://doi.org/10.47067/ramss.v8i1.448

Ologbosere, O. (2023). Data Literacy and Higher Education in the 21st Century. *IASSIST Quarterly*. https://doi.org/10.29173/iq1082

Pamuji, S., & Iliasu, S. F. (2026). Strengthening the Inclusive Role of Muslim Communities in the Digital Space: Preaching Strategies and Social Media Literacy in the 5.0 Era. *Indonesian Journal of Progressive Pedagogy, 2*(2), 101–113. https://doi.org/10.61987/ijpp.v2i2.1788

Pinto, M., Caballero-Mariscal, D., García-Marco, F.-J., & Gómez-Camarero, C. (2023). A Strategic Approach to Information Literacy: Data Literacy. A Systematic Review. *El Profesional de la Información*. https://doi.org/10.3145/epi.2023.nov.09

Putra, B. S., & Soma, A. M. (2025). The Impact of Fintech, E-Commerce, and Skills on MSME Financial Performance: Financial Literacy and Trust as Mediators. *Business and Applied Management Journal*, *3*(2), 300–314.

Putri, R. M., Fadliah, H., & Yuliarti, R. (2026). The Influence of Digital Literacy Competence on Teacher Readiness to Adapt to the Digital Transformation of Education. *Journal of Social Studies and Education*, *4*(1), 63–74.

Rea, B., Worthman, S., Shetty, P., Alexander, M., & Trilk, J. (2021). Medical Education Transformation: Lifestyle Medicine in Undergraduate and Graduate Medical Education, Fellowship, and Continuing Medical Education. *American Journal of Lifestyle Medicine, 15*, 514–525. https://doi.org/10.1177/15598276211006629

Šalamon, D., Blašković, L., Džidić, A., Varga, F., Seljan, S., & Bosnić, I. (2024). Data Literacy in Higher Education of Agricultural Sector: Mapping Competences in the Course Content. *Cogent Education, 11*. https://doi.org/10.1080/2331186X.2024.2393502

Surendran, D., Arulkumar, V., Aruna, M., Sangamithrai, K., & Thangadurai, N. (2024). Improving the Quality of Education Through Data Analytics and Big Data Contributions. *1st International Conference on EMMA-2021*. https://doi.org/10.1063/5.0183570

Taş, E. (2023). Data Literacy Education Through University-Industry Collaboration. *Information and Learning Sciences*. https://doi.org/10.1108/ILS-06-2023-0077

Wang, Q., & Liu, F. (2025). An Empirical Study on the Digital Literacy Level of College Students in Applied Universities Based on Situational Learning Theory. *Education Reform and Development*. https://doi.org/10.26689/erd.v7i10.12774