

COMPARATIVE STUDY OF E-LEARNING INNOVATION DIFFUSION IN URBAN AND RURAL SCHOOLS

Khairun Syari'ah¹, Budiyono², Atikah Nur Halisah³

^{1,2} Intitut Agama Islam Negeri Pontianak ³ Universitas Tanjungpura Pontianak

¹khairunsyariah14102002@gmail.com, ²budiyono@iain.ptk.ac.id,

³atikahnurhalisah@gmail.com

ABSTRACT

The rapid development of digital technology has accelerated transformation in the education sector, particularly through the implementation of e-learning as an instructional innovation. This study aims to analyze the differences in the diffusion patterns of e-learning innovation between urban and rural schools. Using a quantitative comparative approach, the research involved 43 respondents selected through purposive sampling from schools that have implemented e-learning systems. Data were collected using a Likert-scale questionnaire developed based on Diffusion of Innovations theory, covering five indicators: relative advantage, compatibility, complexity, trialability, and observability. Data analysis included descriptive statistics, normality and homogeneity tests, Independent Sample t-test, and effect size calculation (Cohen's d). The results indicate that both groups met the assumptions of normality and homogeneity. The Independent Sample t-test revealed a significant difference in diffusion patterns between urban and rural schools ($t(41) = 18.353$; $p < 0.05$). The mean difference of 18,561 shows that diffusion patterns in urban schools are significantly higher than in rural schools. The calculated effect size ($d = 2.87$) falls into the very large category, indicating a strong practical significance of the difference. These findings suggest that infrastructure availability, access to technology, social communication networks, and exposure to innovation significantly influence the diffusion process. The study contributes to the understanding of digital divide issues and enriches the theoretical application of innovation diffusion in educational technology contexts across different geographical settings.

Keywords: *Difussion, E-Learning, Innovation, Technology*

A. Introduction

The development of digital technology has accelerated transformation in various sectors, including education. One form of this transformation is the use of e-learning

as a learning innovation. E-learning is no longer seen as merely a supplement, but has become an essential requirement in supporting 21st-century learning, which emphasizes flexibility, independence, and the integration of digital

technology.(Kango et al., 2019). According to research(Romadhan et al., 2021) Technological developments such as artificial intelligence, big data, and the Internet of Things (IoT) have enriched the digital learning ecosystem through learning analytics, adaptive learning, and data-driven interaction systems. E-learning is a learning system that utilizes information and communication technology, particularly the internet, to facilitate both synchronous and asynchronous teaching and learning processes.(Yusuf Salam, 2024)This system allows students to access learning materials flexibly through various digital devices. In research bySusanti et al., (2022)The concept of e-learning evolved with advances in computer technology, marked by the introduction of computer-based instruction systems such as PLATO, developed by the University of Illinois Urbana-Champaign. As technology advanced, e-learning transformed into a more interactive and adaptive internet-based learning platform.

In Indonesia, the implementation of e-learning has accelerated significantly since the

Covid-19 pandemic. This situation has encouraged educational institutions to adopt online learning systems on a large scale. Research (Priaggita & Meliyawati, 2022) showThe results show that post-pandemic, the use of e-learning continues through a hybrid (blended learning) model. Various digital learning platforms are beginning to be integrated into educational practices. However, the implementation of e-learning in schools is not uniform.(Noriska et al., 2021)Differences in regional characteristics, infrastructure availability, and human resource readiness lead to variations in the adoption process of learning technology innovations. Previous research has shown gaps in the adoption of educational technology. A study conducted by(Kurniawan & Rofiah, 2020)revealed that schools in urban areas tend to adopt e-learning innovations more quickly than schools in rural areas. This difference is influenced by technological infrastructure, internet access, and digital literacy. Several other studies have focused more on technology acceptance, the effectiveness of e-learning on learning outcomes, and

technical implementation challenges (Ndhiroh, 2017).

Extensive research has been conducted on the adoption and utilization of e-learning in various educational contexts. However, studies specifically comparing innovation diffusion patterns based on school district characteristics are still relatively limited. Research by Everett M. Rogers confirms that successful innovation adoption is influenced by perceptions of the innovation, communication channels, and social systems. This theory serves as the primary foundation for various studies on educational technology adoption. Several empirical studies have shown that infrastructure and user readiness are important determinants of e-learning implementation. A study by Fred D. Davis, using the Technology Acceptance Model (TAM), showed that perceived usefulness and perceived ease of use significantly influence the acceptance of learning technology (Wicaksono, 2022). Other research has found that the digital divide remains a major issue in the adoption of educational technology. A UNESCO study showed that schools in rural areas tend to face limited

access to technology, resulting in low levels of e-learning integration. Furthermore, research by the OECD revealed that differences in social and economic contexts contribute to variations in the use of digital technology in educational institutions. Schools with better infrastructure support demonstrate higher rates of innovation adoption.

Although various studies have examined e-learning, most of them are still focused on the effectiveness of technology use and acceptance. Studies that specifically examine the diffusion patterns of e-learning innovations, especially in the context of regional differences in schools, are still relatively limited. However, according to the diffusion of innovation theory proposed by (Rogers, 1995) The innovation adoption process is influenced not only by technological characteristics, but also by social systems, communication channels, and the role of change agents. The novelty of this research lies in its comparative approach, which emphasizes the diffusion process of e-learning innovations, not solely on the level of acceptance or effectiveness of their use. This research analyzes how

innovations are introduced, communicated, and reinforced in school ecosystems with different regional characteristics. Thus, this research contributes to enriching the study of the diffusion of educational technology innovations, particularly in the context of the digital divide between regions. Based on these conditions, this study aims to analyze the differences in e-learning innovation diffusion patterns between urban and rural schools. This research is expected to contribute to understanding the dynamics of educational technology innovation adoption in different social and geographic contexts.

B. Methodology

This study uses a quantitative approach with a comparative approach. The quantitative approach was chosen because the study aims to objectively examine differences through statistical analysis, while the comparative design is used to compare phenomena across two distinct groups: urban and rural schools. According to (Creswell, 2013) Comparative quantitative research aims to identify differences between groups based on specific

variables through numerical measurements and statistical analysis. Similarly, Sugiyono explained that comparative research is used to compare the conditions of two or more groups to determine whether there are significant differences.

This study aims to analyze the differences in e-learning innovation diffusion patterns between urban and rural schools. The independent variable in this study is the characteristics of the school area (urban and rural), while the dependent variable is the diffusion of e-learning innovation. Data collection was conducted using a Likert scale questionnaire, which was compiled based on the innovation diffusion indicators according to Everett M. Rogers, including: Relative

Advantage, Compatibility, Complexity, Trialability and Observability. The research instrument was designed to measure respondents' perceptions of the adoption and implementation of e-learning in schools.

The research sample was determined using a purposive

sampling technique, taking into account certain criteria, namely schools that have implemented e-learning. This technique was chosen because the study requires respondents relevant to the context of learning technology innovation. Data analysis was conducted using descriptive statistical tests to describe data trends in each group. Normality tests were used to determine data distribution. Homogeneity tests were used to ensure equality of variance between groups. The Independent Sample t-test was used if the data were normally distributed. The Mann–Whitney U Test was used if the data were not normal. Effect Size (Cohen's *d*) measures the magnitude of the difference found. According to Jacob Cohen, effect size is important in comparative research because it provides information about the strength of the difference, not just statistical significance.

C. Result and Discussion

Result Diffusion & Innovation in urban schools

Indicator	Urban
Relative Advantage	4.23
Compatibility	3.93
Complexity	4.19
Trialability	4.22
Observability	4.12

Based on the descriptive analysis results, urban schools demonstrated a high level of e-learning innovation diffusion across all indicators. The Relative Advantage indicator obtained an average of 4.23, indicating that respondents in urban areas viewed e-learning as having clear advantages over conventional learning methods. The Compatibility indicator obtained an average of 3.93, indicating that e-learning was considered quite appropriate to the needs, values, and learning systems that have been implemented in schools. The Complexity indicator obtained an average of 4.19, indicating that e-learning was perceived as relatively easy to understand and use by both teachers and students.

Furthermore, the Trialability indicator showed an average of 4.22, indicating that urban schools have ample opportunity and flexibility to trial and test e-learning systems before fully implementing them. The Observability indicator averaged 4.12, indicating that the benefits and outcomes of e-learning use can be clearly observed by the school community.

Overall, the average score above 4 indicates that the diffusion process of e-learning innovation in urban schools is in the high category and is running optimally.

Diffusion & Innovation in rural schools

Indicator	Rural
Relative Advantage	3.37
Compatibility	3.35
Complexity	3.31
Trialability	3.39
Observability	3.41

In contrast to urban schools, rural schools showed an average score in the moderate category. The Relative Advantage indicator averaged 3.37, indicating that e-learning was considered quite beneficial, but not yet fully superior to previous learning methods. The Compatibility indicator averaged 3.35, indicating that e-learning's suitability to school needs and conditions was

still at a sufficient level. The Complexity indicator averaged 3.31, indicating that some respondents still found the e-learning system difficult to use.

Furthermore, the Trialability indicator showed an average of 3.39, indicating limited opportunities to try or test e-learning before full implementation. The Observability indicator averaged 3.41, indicating that the results and benefits of e-learning use have not yet been fully observed in rural schools. Overall, the average range of 3.30–3.40 indicates that the diffusion of e-learning innovation in rural schools is still in its infancy and not as robust as in urban areas.

Comparative Analysis of Urban and Rural School Diffusion & Innovation

Tests of Normality							
Village_City		Kolmogorov-Smirnova			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	sig.
Diffusion pattern	Urban	.167	21	.131	.913	21	.064
	Rural	.134	22	.200*	.957	22	.433

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Based on the results of the normality test analysis using Shapiro-Wilk, a significance value of 0.06 ($p >$

0.05) was obtained in the urban area group with a sample size of 21 respondents, and 0.433 ($p > 0.05$) in the rural area group. Since both

significance values are greater than 0.05, it can be concluded that the diffusion pattern data in both groups are normally distributed. With the normality assumption fulfilled, the next comparative analysis uses a parametric statistical approach through the Independent Sample t-test.

Because both groups met the normality assumption, the parametric independent sample test was used to determine the differences in diffusion patterns between urban and rural areas.

there is a significant difference between the diffusion patterns of urban and rural areas. The average difference of 18.561 indicates that the diffusion pattern in urban areas is higher than in rural areas.

$$r = \frac{Z}{\sqrt{N}}$$

Information:

- Z = Z value of the Mann-Whitney test output
- N = total number of samples

$$\sqrt{41} = 6,403$$

$$d = \frac{18,353}{6,403}$$

$$d = 2,87$$

Cohen's Criterion:

- 0.20 = small
- 0.50 = medium
- 0.80 = large

Independent Samples Test									
	Levene's Test		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Standard Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Diffusi on pattern	.145	.706	18,353	41	.000	18,561	1,011	16,518	20,603
			18,344	40,804	.000	18,561	1,012	16,517	20,604

Based on the results of the Independent Sample t-test, the Levene's Test value was 0.706 ($p > 0.05$), so the variance of the two groups was declared homogeneous. Therefore, the analysis used the Equal Variances Assumed row. The t-test results showed a value of $t(41) = 18.353$ with a significance value of 0.000 ($p < 0.05$). This indicates that

Because $d = 2.87$, then: The effect size is included in the very large effect category. The effect size calculation using Cohen's d formula yielded a value of 2.87. Based on Cohen's criteria, this value falls into the very large effect category. This indicates that the difference in diffusion patterns between urban and rural areas is not

only statistically significant but also has a very strong practical impact.

The high rate of diffusion of e-learning innovations in urban schools can be explained through the diffusion of innovation theory proposed by Everett M. Rogers in **Diffusion of Innovations**. Rogers explained that the successful adoption of an innovation is largely determined by five key attributes: relative advantage, compatibility, complexity, trialability, and observability. If these five attributes are perceived positively by users, the adoption process will occur more quickly and broadly within a social system. The concept of relative advantage emphasizes that innovations will be more readily accepted if they are perceived to provide greater benefits than previous practices. According to research (Chusna, 2019) E-learning is often seen as enhancing learning flexibility, expanding access to learning resources, and supporting technology-based interactions. When school members experience these benefits in real-time, the tendency to adopt innovations becomes stronger.

Furthermore, compatibility refers to the degree to which an innovation

aligns with the values, needs, and prior experiences of users. Innovations that align with an organization's culture and work habits will be more easily integrated into existing systems. (Nuzulismah et al., 2022) School environments that already have a culture of digital literacy and support for technology-based policies tend to exhibit a more stable and sustainable diffusion process. In terms of complexity, Rogers emphasized that innovations perceived as easy to understand and use will be adopted more quickly. This aligns with the Technology Acceptance Model (TAM) developed by Fred D. Davis, which states that perceived ease of use significantly influences technology acceptance. The lower the level of complexity of a system, the higher the level of user acceptance of that technology. Trialability also plays a crucial role in reducing uncertainty about innovation. Rogers explained that the opportunity to try an innovation on a limited scale allows users to evaluate its benefits and risks before fully adopting it (Venkatesh & Bala, 2008). Environments that provide space for experimentation and technical support

typically exhibit a more progressive adoption process.

Meanwhile, observability relates to the extent to which the results of innovation can be seen and felt by members of the social system. Research results show (Mulyati et al., 2023) When the positive impact of an innovation is clearly visible, the spread of the innovation accelerates as others are encouraged to follow the proven success of the experience. This demonstrates that the visibility of technology adoption contributes to strengthening the diffusion process. Furthermore, the digital divide theory, widely discussed by institutions such as UNESCO and the OECD, emphasizes that differences in access to infrastructure, digital literacy, and policy support can influence the level of technology integration in educational institutions. Schools with adequate infrastructure and digital ecosystem support tend to demonstrate higher levels of innovation adoption.

Discussion

The results of this study indicate that the diffusion of e-learning innovations in urban schools is more optimal than in rural schools. This finding aligns with various recent

studies that confirm that the successful adoption of educational technology is greatly influenced by infrastructure readiness, organizational support, and user digital literacy. Research by (Susanti et al., 2022) Studies have shown that schools with stable internet access, the availability of digital devices, and strong internal policy support tend to have higher levels of e-learning integration. Research on e-learning adoption readiness at the secondary education level in developing countries confirms that institutional readiness is a key factor in accelerating the adoption process. This readiness includes technical aspects, teacher competency, and an organizational culture that supports innovation. Furthermore, research on the diffusion of technology-based learning innovations in Indonesia also found that interventions such as supporting internet access and school digitalization policies can accelerate technology adoption by teachers and students. This suggests that structural and policy factors significantly contribute to the spread of educational innovations.

A systematic literature review of educational technology adoption

also identified several key determinants, such as perceived usefulness, ease of use, technical support, and school leadership. Schools with transformational leadership and a clear digital vision tend to demonstrate a more systematic and sustainable diffusion process.(Sadikin & Hakim, 2019)An adaptive environment facilitates the integration of innovation into everyday learning practices. In the context of regional differences, various international reports from UNESCO confirm that the gap in access to technology remains a major challenge to equitable digital education. Schools in areas with limited infrastructure face barriers to utilizing online learning platforms, both in terms of connectivity and device availability.(Sukma et al., 2019).

In line with this, the OECD report also shows that socio-economic factors and local policy support influence variations in the use of digital technology in educational institutions.(Perdana et al., 2021). Schools located in better resourced environments tend to have higher and more sustained levels of technology integration. Previous research by(Handayani et al., 2024)showThe

impact of e-learning adoption on learning interactions also revealed that when technology is implemented effectively, student participation, flexibility in access to materials, and efficiency in learning management increase. This reinforces the assumption that perceived tangible benefits will accelerate the diffusion of innovation within the school's social system.

Thus, the findings of this study are consistent with various empirical studies and literature reviews that suggest that the successful diffusion of e-learning innovations is influenced by a combination of technological, organizational, social, and policy factors. Differences in regional contexts are not only related to geographic factors but also reflect differences in the readiness of education systems to comprehensively integrate technology.

Factors that influence the pattern of differences

The statistically significant difference in diffusion patterns between urban and rural areas, with a very large effect size ($d = 2.87$), is due to various contextual factors that influence the process of information

and innovation dissemination. These factors include infrastructure, access to technology, social characteristics, and the intensity of interaction with information sources.

Infrastructure and Technology Access Factors

Urban areas generally have more adequate infrastructure, such as stable internet connections, the availability of technological devices, and access to a variety of information media. This allows for faster and more widespread diffusion because information can be received through various channels, both digital and non-digital. Conversely, rural areas still face limited technological infrastructure, which slows down the dissemination of information. According to research by (Noriska et al., 2021) Although technology has begun to reach rural areas, the intensity and quality of access are not as optimal as in urban areas. This situation aligns with UNESCO's view that the digital access gap remains a major factor affecting the equitable distribution of information and technology-based learning.

Social Characteristics and Communication Networks

From a social perspective, urban communities tend to have broader and more heterogeneous communication networks. Interactions with various social groups allow information and innovation to spread through multiple channels simultaneously. Furthermore, research findings (Mulyati et al., 2023) shows that the intensity of mass media and digital media use in urban areas accelerates the diffusion process. In contrast, rural communities generally have more homogeneous social networks and are limited to local communities. According to (Noriana et al., nd) Information diffusion occurs more often through direct interpersonal communication. Although social ties in rural areas are relatively strong, the limited variety of information sources causes the diffusion process to be slower and less intensive than in urban areas. This condition aligns with the diffusion of innovation theory proposed by Everett Rogers in **Diffusion of Innovations**, which states that social systems and communication channels play a crucial role in determining the speed and pattern of diffusion.

Level of Exposure to Innovation

Another factor that influences differences in diffusion patterns is the level of exposure of society to innovation. (Rosida, 2024) Urban communities tend to be more frequently exposed to new innovations through education, employment, media, and dynamic social environments. This encourages the emergence of early adopters, who act as agents of innovation dissemination. Meanwhile, rural communities are relatively more selective in accepting new innovations. The adoption process typically takes longer due to considerations of tradition, local customs, and levels of trust in information sources.

D. Conclusion

Based on the research results and discussion, it can be concluded that the diffusion of e-learning innovation in urban schools is proceeding optimally and is categorized as high. This indicates that the innovation characteristics, including perceived benefits, suitability to needs and learning systems, ease of use, opportunities for trial and error, and visibility of implementation results, have been positively received by the school community. These findings

indicate that infrastructure readiness, institutional support, and the digital competence of teachers and students play a significant role in strengthening the innovation adoption process. School environments that are adaptive to change and have adequate resource support tend to be able to integrate e-learning more systematically and sustainably. Theoretically, the results of this study strengthen the relevance of the diffusion of innovation theory in the context of digital transformation in education. Practically, this study emphasizes the importance of strengthening policies, increasing human resource capacity, and equalizing access to technology as strategies to expand and optimize e-learning implementation in various regional contexts.

REFERENCES

- Chusna, N. L. U. (2019). PEMBELAJARAN E-LEARNING. *Prosiding Seminar Nasional Pendidikan KALUNI*, 2. <https://doi.org/10.30998/prokaluni.v2i0.36>
- Handayani, L., Lebang, R., Prov, S. B., Timur, K., Eriza, F., Kb, R., Tk, I., Samarinda, A. A., & Warman, W. (2024). *Critical Review of*

- Technology-Based Education Supervision Models: Implications for Improving The Quality of Learning in The Digital Age.*
- Jhon W. Creswell. (2013). *Research design pendekatan kualitatif, kuantitatif dan mixed*. Pustaka Pelajar.
- Kango, R., Ghazi, S., Elektronika, P. T., Elektro, J. T., Balikpapan, N., Soekarno Hatta, J., Utara, K. B., Balikpapan, K., Timur, K., Penelitian, P., & Pengabdian Kepada Masyarakat, D. (2019). TANTANGAN PEMBELAJARAN E-LEARNING DI PERGURUAN TINGGI. In *Seminar Nasional Teknologi*.
- Kurniawan, M. R., & Rofiah, N. H. (2020). Pola Penggunaan Internet di Lingkungan Sekolah Dasar Se-Kota Yogyakarta. *Southeast Asian Journal of Islamic Education*, 2(2), 93–105. <https://doi.org/10.21093/sajie.v2i2.1930>
- Mulyati, I., Mansyuruddin, M., Adrianus, A., Bahari, Y., & Warneri, W. (2023). Proses Difusi Inovasi dalam Penerapan Metode Pengajaran Baru. *EDUKATIF: JURNAL ILMU PENDIDIKAN*, 5(6), 2425–2433. <https://doi.org/10.31004/edukatif.v5i6.5769>
- Ndhiroh Faridatun. (2017). *Analisa Efektifitas Sistem Pembelajaran Berbasis E-Learning* Faridatun Nadziroh. 2(1).
- Noriana, S., Hasim, A., & Abu Bakar, K. (n.d.). *Challenges and Impacts of Technology Adoption in Education: A Systematic Literature Review*. <https://doi.org/10.47772/IJRISS>
- Noriska, N. J., Widyaningrum, R., & Nursetyo, K. I. (2021). Pengembangan Microlearning pada Mata Kuliah Difusi Inovasi Pendidikan di Prodi Teknologi Pendidikan. *Jurnal Pembelajaran Inovatif*, 4(1), 100–107. <https://doi.org/10.21009/jpi.041.13>
- Nuzulismah, R. S., Santoso, H. B., & Hadi Putra, P. O. (2022). *E-LEARNING ADOPTION READINESS IN SECONDARY EDUCATION OF DEVELOPED AND DEVELOPING COUNTRIES: A SYSTEMATIC LITERATURE REVIEW*. 11(4).
- Perdana, M. A., Wibowo, D. E., & Kamil Budiarto, M. (2021). *Digitalization of Learning Media through Digital Book Development Using the Flipbook Application*. 54, 263–272. <https://doi.org/10.23887/jpp.v54i2>
- Prianggita, V. A., & Meliyawati, M. (2022). Peran Media Pembelajaran Berbasis Teknologi Informasi Dan Komunikasi Di Era Pandemi Covid-19. *Aksara: Jurnal Ilmu Pendidikan Nonformal*, 8(1), 147. <https://doi.org/10.37905/aksara.8.1.147-154.2022>

- Rogers, E. M. . (1995). *Diffusion of innovations*. Free Press.
- Romadhan, M. I., Cahyo, B., & Pradana, S. A. (2021). *Third Conference on Research and Community Services STKIP PGRI Jombang Berinovasi di Masa Pandemi “Penelitian dan Pengabdian Masyarakat di Era Kampus Merdeka-Merdeka Belajar” DIFUSI INOVASI VIDEO PODCAST SEBAGAI MEDIA E-LEARNING DI KALANGAN MAHASISWA ILMU KOMUNIKASI UNTAG SURABAYA*.
- Rosida, W. U. (2024). *The Utilization of Audio-Visual Learning Media in Learning Islamic Cultural History for Grade 10 High School Students*.
- Sadikin, A., & Hakim, N. (2019). Pengembangan Media E-Learning Interaktif Dalam Menyongsong Revolusi Industri 4.0 Pada Materi Ekosistem Untuk Siswa SMA. *BIODIK*, 5(2), 131–138.
<https://doi.org/10.22437/bio.v5i2.7590>
- Sukma, A. E., Hadi, M., & Nikmah, F. (2019). *PENGARUH TECHNOLOGY ACCEPTANCE MODEL (TAM) DAN TRUST TERHADAP INTENSI PENGGUNA INSTAGRAM*.
- Susanti, E., Assegaff, S., Sistem Informasi, M., Dinamika Bangsa, U., & Jl Jend Sudirman Thehok-Jambi, J. (2022). *Sistem E-Learning Berbasis Web Pada SMA Negeri 1 Merangin* (Vol. 7, Number 4).
- Venkatesh, V., & Bala, H. (2008). Technology Acceptance Model 3 and a Research Agenda on Interventions. In *The Author Journal compilation C* (Vol. 39). Decision Sciences Institute.
- Wicaksono, S. R. (2022). *Teori Dasar Technology Acceptance Model*. CV. Seribu Bintang.
www.fb.com/cv.seribu.bintang
- Yusuf Salam, M. (2024). *Ihya Al-Arabiyyah; Jurnal Pendidikan Bahasa dan Sastra Arab A CASE STUDY ON LINGUISTIC ERRORS IN ARABIC LANGUAGE LEARNING AT STATE ISLAMIC SENIOR HIGH SCHOOL (MAN) INSAN CENDEKIA BATAM CITY I H Y A A L-A R A B I Y A H; J U R N A L P E N D I D I K A N B A H A S A D A N S A S T R A A R A B*.