Journal of Learning Improvement and Lesson Study
Volume 4, Number 2, 2024, pp, 24-35
E-ISSN: 2798-9011
DOI: 10.24036/jlils.v4i2.112
Received September 17,2024; Revised November 05,2024; Accepted November 29,2024
Availaible Online: https://jlils.ppj.unp.ac.id

Analysis Distribution and Affordability of Educational Field Practices Geography Education Students

Sri Mariya[1*], Syafri Anwar[2], Yurni Suasti[2], Mona Adria Wirda[3]
[1] Postgraduate Doctoral Student in Education, Padang State University, Indonesia
[2] Department of Geography, Padang State University, Indonesia
[3] Department of Geography Education, Universitas Negeri Medan, Indonesia
*Corresponding author, e-mail: srimariya_geo@fis.unp.ac.id

Abstract
This research aims to analyze the distribution and accessibility of educational field practice (PLK) locations as places where teaching by Geography Education Field Practice students in Padang City. The method used in this research is the euclidean distance method to estimate and reflect the direct distance between the locations of schools by measuring the distance to school points (maximum and minimum) which tend to be the goals of PLK activities in Padang City from 2021 to 2023. Analysis carried out carried out divided into sub-district areas in Padang City. The results of analysis distribution of PLK location selection are spread across several schools in eleven sub-districts. The affordability of location shows that there are differences in the geographical distribution of educational field practice schools in Padang City. Distribution of maximum and minimum distance variations between schools and between different sub-districts through analysis with the help of the Geography Information System. The results of the affordability analysis explain that there is a difference between the maximum and minimum distance between schools and the number of students who choose teaching practice locations from the outermost area of the sub-district. Where areas closer to school points are an option for prospective PLK students.

Keywords: Educational Field Practices, distribution, affordability

Introduction

Educational Field Practice (PLK) is one of the mandatory courses carried out by educational colleges. Activities carried out in the form of teaching practice in partner schools. Every education student is obliged to carry out these activities, especially in the Geography Education Study Program. Educational Field Practice is a graduation requirement that students must complete. This allows students to directly observe and practice the knowledge gained in higher education by observing a phenomenon and connecting it with theoretical concepts learned in class in the form of empirical observations and data collection in the field. Fieldwork is recognized as an essential component of geography curricula, providing students with practical experiences that enhance their learning and understanding of theoretical concepts (Kent et al., 1997).geography field practice is crucial for training professionals in geographical sciences, highlighting its role in bridging theoretical knowledge and practical application (Zhang et al., 2019). Learning activities at school provide real experience for students to study geographic phenomena in the field and convey this directly to students (Fuller et al., 2006).

Through practical fieldwork activities, students have the opportunity to develop a variety of cognitive and technical skills that are important for increasing expertise in science in the field of geography education, including spatial awareness, field observation techniques, field data collection methods, analytical skills, communication skills, and teamwork collaborative (Boyle et al., 2007; Cook, 2010). Landscape of higher education, characterized by increasing diversity among student populations and changing expectations, presents both challenges and opportunities for fieldwork education. As universities adapt to a more inclusive environment, it is essential to ensure that all students receive high-quality fieldwork experiences that reflect their diverse backgrounds and needs (Larkin & Watchorn, 2012). In the last 40 years, the Journal of

Geography in Higher Education (JGHE) has discussed the development of field practice methodology in geography education (France & Haigh, 2018).

So far, technological developments have greatly influenced the design and implementation of field practices, the significant benefits of integrating performance-centered mobile learning into fieldwork education for students. the research demonstrates that mobile technology not only enhances students' engagement and motivation but also facilitates the application of theoretical knowledge in real-world contexts. Students reported improved understanding of core concepts and appreciated the flexibility and accessibility that mobile devices provided during their learning experiences. Overall, the findings suggest that adopting mobile learning approaches in fieldwork can lead to deeper learning outcomes and better prepare students for future professional environments (Stoyanova-Petrova, 2011). Several studies apply the use of GPS, geographic applications, and social media, which can enrich students' learning experiences while in the field (France & Haigh, 2018; Fuller et al., 2006). On the other hand , the integration of research with learning in the field is also increasingly normalized which is beneficial in providing a deeper learning experience for students (Fuller et al., 2006).

Field-based teaching is a powerful way to help students learn. By being outdoors and engaging with nature, students can understand complex ideas in a simple and enjoyable way. They learn not only from books but also from the world around them, making their education richer and more meaningful (Vácha & Ditrich, 2021). The uneven distribution of field practice sites often creates challenges for geography education students, particularly in rural or remote areas. Field practice opportunities may be concentrated in urban or more accessible regions, limiting students' exposure to diverse settings and creating disparities in educational experiences. This imbalance can be exacerbated by factors such as reduced transportation options, limited technology infrastructure, and fewer placement partnerships in rural areas. Studies in rural education note that rural communities may have fewer resources, leading to limited accessibility for fieldwork and career readiness programs. Distance and isolation further hinder equitable access to high-quality field sites, which can impact students' learning and professional development by restricting exposure to practical geographic phenomena and field-based learning in diverse environments. Moreover, the lower availability of mentors and technology resources in rural locations can make it challenging for students to receive adequate support during field placements, as seen in social work and teacher education contexts, which often face similar accessibility issues (Wright R, 2019; Zahl-Thanem & Rye, 2024).

Based on the above background, it is necessary to measure distance estimates or analyze the distribution of Geography education field practice students with the estimated object covering the sub-district areas in Padang City to see the affordability of locations for field practice practice or schools as places where teaching practice activities are held. carried out by students from 2021 -2023.

Method

The method used in this research is Euclidean Distance . This method is a distance measurement technique used to estimate and reflect the direct distance between two points in a regional space. Euclidean distance performs well and is widely used in various applications, including software development and robotics (Huang et al., 2020; Liu et al., 2018). Although its accuracy is slightly lower than that of ANN, it offers advantages in terms of ergonomic design and hardware requirements. The dimensions of each point in Euclidean distance can be adjusted based on specific needs.

The formula used in calculating **Euclidean Distance** is as follows:

$$d = \sqrt{[(x2 - x1)2 + (y2 - y1)2]}$$

Where ,

d = Euclidean Distance

(x1 , y1) = coordinates of the first point

(x2 , y2) = coordinates of the second point

In mapping, Euclidean distance estimation can provide information in the form of a measure of the closest and furthest distance that can be reached by an object point in a spatial area. In this case, euclidean distance measures the distance to school points that tend to be the target of PLK activities in Padang City from 2021 to 2023, where the results are divided into the coverage of each sub-district in the city.

Several studies have applied the Euclidean distance algorithm to analyze various types of data. (Berthold & Höppner, 2016) shown that the squared Euclidean distance on z-score normalized vectors is equivalent to the inverse of the Pearson Correlation coefficient up to a constant factor. This result is especially of interest for a number of time series clustering experiments where Euclidean distances are applied to normalized data as it shows that the authors in fact were often using something close to or equivalent to the Pearson correlation coefficient. (Knowles & Gao, 2023)research demonstrates that the Euclidean distance matrix (EDM) and then used the theory to propose a new EDM-based method for Global navigation satellite systems (GNSS) signal error detection and exclusion. Using two real-world datasets, they validated the theory that EDM-based fault detection and exclusion (FDE) has superior computational complexity when increasing the number of hypothesized errors and accepted measurements compared to solution separation and residual-based FDE. The study also showed that EDM-based FDE rivals solution separation and residual-based FDE in terms of exclusion accuracy. EDM-based FDE was shown to detect and exclude measurement errors when using a wider range of threshold parameters than solution separation or residual-based FDE.

Other research such as (Mesquita et al., 2017) proposes a method for estimating the expected value of Euclidean distances between incomplete feature vectors under the "Missing at Random" (MAR) assumption. The proposed method, called Expected Euclidean Distance (EED), models the distance using a Nakagami distribution, with parameters derived from the moments of the unknown data distribution, which is approximated by a mixture of Gaussians. Many machine learning methods assume complete data, but real-world datasets often have missing values. Traditional approaches like listwise deletion can lead to loss of information. EED directly computes the expected Euclidean distance based on the Nakagami distribution, utilizing maximum likelihood estimation to handle incomplete data scenarios effectively. The method is integrated into the Minimal Learning Machine (MLM), a distance-based supervised learning algorithm. Experimental results indicate that EED outperforms existing methods, such as Conditional Mean Imputation (CMI) and Expected Squared Distance (ESD), particularly in scenarios with significant missing data. The authors conducted experiments using both synthetic and real-world datasets, demonstrating that EED provides more consistent and accurate distance estimates in the presence of missing values. Overall, the study highlights EED as a promising alternative for computing distances in datasets with missing attributes, improving the performance of distance-based learning methods.

In general, Euclidean distance has been proven to be able to measure similarities between objects effectively for various data analysis applications such as clustering , classification, pattern matching , outlier detection, and system recommendations.

Results and Discussion

1. Distribution and Affordability of 2021 Educational Field Practice locations

Educational Field Practices which will be carried out in 2021 in Padang City are spread across seven sub-districts out of 11 sub-districts in Padang City. The number of students taking PLK was 17 people spread across 9 schools. The results of the distribution and reachability analysis can be seen from the following map and table.

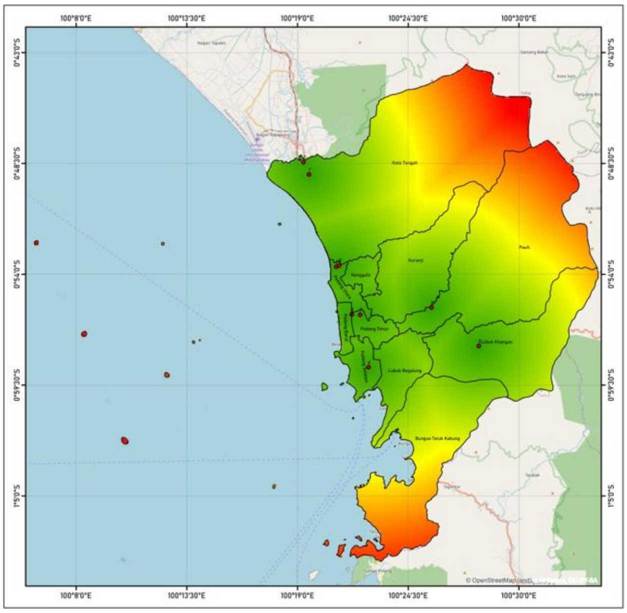

Figure 1. Map of Estimated Distance for Educational Field Practices in 2021

Table 1. Variations in Maximum and Minimum Distances Between Districts in 2021

No	Subdistrict	School name	Number of PLK Students	x	y	Max distance between PLK (m)	Min distance between PLK (m)
1	Bungus Teluk Kabung	-	0	-	-	3486.65	28665.5
2	Koto Tangah	SMAN 7 Padang	3	-0.8175	100,326	25786.6	0
		SMAN 8 Padang	2	-0.8074	100,322		
3	Kuranji	-	0	-	-	10052.8	367,016
4	Lubuk Begalung	-	0	-	-	6982.96	917.54
5	Lubuk Refinery	SMAN 14 Padang	1	-0.9594	100,467	12978.6	0
6	Nanggalo	-	0	-	-	3961.39	734,032
7	South Padang	SMAN 6 Padang	2	-0.9769	100,376	24257.1	0

No	Subdistrict	School name	Number of PLK Students	x	y	Max distance between PLK (m)	Min distance between PLK (m)
8	East Padang	Adabiah 2 Padang High School	2	-0.9335	100,369	3778.66	0
		Bunda Padang High School	2	-0.9332	100,362		
9	North Padang	SMAS Development	2	-0.8938	100,349	2728.04	0
		Pertiwi 1 Padang High School	2	-0.8928	100,351		
10	West Padang	-	0	-	-	3007.75	183,508
11	Pauh	SMAN 9 Padang	1	-0.9275	100,428	18040.8	0

Variations in Maximum and Minimum Distances Between Districts in 2021

Based on the interpretation of the Euclidean Distance map which models the distribution of destination schools for Educational Field Practices (PLK) in 2021, Bungus Teluk Kabung District has the furthest distance of 28,665.5 meters from the outermost boundary of the sub-district and the shortest distance of 3,486.65 meters to the nearest PLK destination school in surrounding sub-districts. This significant distance indicates that there are no PLK destination schools in the sub-district. Similar conditions also occurred in Kuranji, Lubuk Begalung, Nanggalo and West Padang Districts. On the other hand, a sub-district that has an estimated minimum distance between PLK points of 0 meters indicates that there is a PLK destination school in the sub-district. This distance of 0 meters indicates that there is a distribution of students doing PLK in the area, so there is no need to worry about the uneven distribution of PLK activities in it. Meanwhile, sub-districts that still have a high minimum distance can be considered as potential areas for PLK students to visit in the future.

2. Distribution and Affordability of 2022 Educational Field Practice locations

Educational Field Practices which will be carried out in 2023 are spread across 8 sub-districts and 13 students in 12 schools. In 2023, the number of students undertaking PLK will decrease from the previous year, this is because the number of education students in the class of 2021 is less than in 2019 and 2020. The results of the distribution and affordability analysis can be seen from the following map and table:

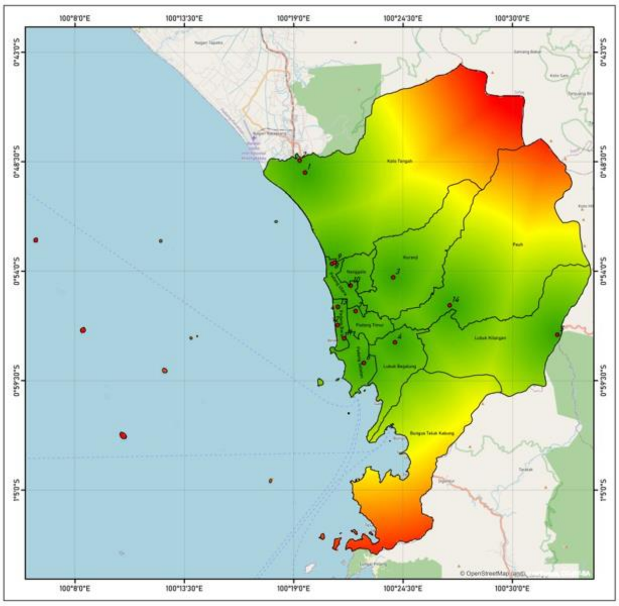

Figure 2. Map of Estimated Distance for Educational Field Practices in 2022

Table 2. Variations in Maximum and Minimum Distances Between Districts in 2022

No	Subdistrict	School name	Number of PLK Students	x	y	Max distance between PLK (m)	Min distance between PLK (m)
1	Bungus Teluk Kabung	-	0	-	-	7802.87	183,508
2	Koto Tangah	SMAN 7 Padang	1	-0.8175	100,326	25786.6	0
		SMAN 8 Padang	3	-0.8074	100,322		
3	Kuranji	SMAN 5 Padang	1	-0.9052	100.4	9654.68	0
4	Lubuk Begalung	SMAN 4 Padang	1	-0.9596	100,402	6982.96	0
5	Lubuk Refinery	Pertiwi 2 Padang High School	2	-0.9533	100,538	7802.87	0
6	Nanggalo	-	0	-	-	3563.08	367,016
7	South Padang	SMAN 6 Padang	2	-0.9769	100,376	24042.3	0
8	East Padang	Adabiah 2 Padang High School	3	-0.9335	100,369	2392.65	0
9	North Padang	SMAS Development	3	-0.8938	100,349	2018.59	0

		Pertiwi 1 Padang High School	4	-0.8928	100,351		
		MAN 2 Padang	1	-0.9121	100,364		
10	West Padang	Xavier Catholic High School	1	-0.9564	100,359	1323.29	0
		Baiturrahman High School	1	-0.9452	100,354		
		SMAN 2 Padang	1	-0.93	100,354		
11	Pauh	SMAN 15 Padang	1	-0.9287	100,448	16751.6	0

Variations in Maximum and Minimum Distances Between Districts in 2022

Based on the interpretation of the Euclidean Distance map which models the distribution of destination schools for Educational Field Practices (PLK) in 2022, Bungus Teluk Kabung District has the furthest distance of 183,508 meters from the outermost boundary of the sub-district and the shortest distance of 7802.87 meters to the nearest PLK destination school in the surrounding sub-district. This significant distance indicates that there are no PLK destination schools in the sub-district. Similar conditions also occurred in Nanggalo District. On the other hand, a sub-district that has an estimated minimum distance between PLK points of 0 meters indicates that there is a PLK destination school in the sub-district. This distance of 0 meters indicates that there is a distribution of students doing PLK in the area, so there is no need to worry about the uneven distribution of PLK activities in it. Meanwhile, sub-districts that still have a high minimum distance can be considered as potential areas to be visited by prospective PLK students for the next period.

3. Distribution and Affordability of Educational Field Practice locations in 2023

Educational Field Practices which will be carried out in 2023 are spread across 8 sub-districts and 13 students in 12 schools. In 2023, the number of students undertaking PLK will decrease from the previous year, this is because the number of education students in the class of 2021 is less than in 2019 and 2020. The results of the distribution and affordability analysis can be seen from the following map and table:

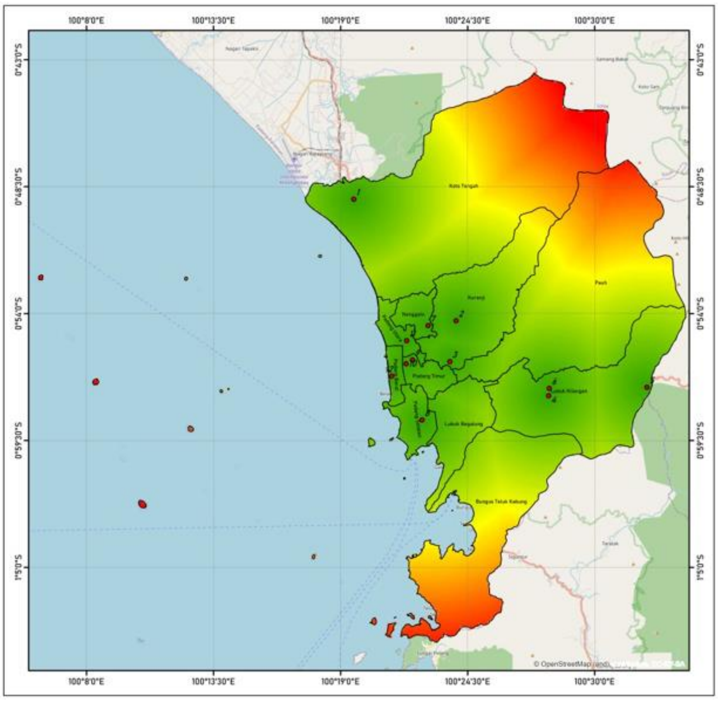

Figure 3. Map of Estimated Distance for Educational Field Practices in 2023

Table 3. Variations in Maximum and Minimum Distances Between Districts in 2023

No	Subdistrict	School name	Number of PLK Students	x	y	Max distance between PLK (m)	Min distance between PLK (m)
1	Bungus Teluk Kabung	-	0	-	-	28665.5	3486.65
2	Koto Tangah	SMAN 7 Padang	1	-0.8175	100,326	26038.1	0
3	Kuranji	SMA 5 Padang	1	-0.9052	100.4	9732.85	0
		Muhammadiyah High School 1	1	-0.9347	100,396		
4	Lubuk Begalung	-	0	-	-	6982.96	917.54
5	Lubuk Refinery	SMAN 14 Padang	2	-0.9594	100,467	7229.38	0
		Pertiwi 2 Padang High School	1	-0.9533	100,538		
		Semen Padang High School	1	-0.9541	100,467		

No	Subdistrict	School name	Number of PLK Students	x	y	Max distance between PLK (m)	Min distance between PLK (m)
6	Nanggalo	SMAN 12 Padang	1	-0.9087	100.38	3308.24	0
7	South Padang	SMAN 6 Padang	1	-0.9769	100,376	24042.3	0
8	East Padang	Adabiah 2 Padang High School	1	-0.9335	100,369	2646.59	0
		Dian Andalah High School Padang	1	-0.9363	100,364		
9	North Padang	SMAN 3 Padang	1	-0.9196	100,364	3670.16	0
10	West Padang	Baiturrahman High School Padang	1	-0.9452	100,354	2232.47	0
11	Pauh	-	0	-	-	17777.6	661,647

Variations in Maximum and Minimum Distances Between Districts in 2023

Based on the interpretation of the Euclidean Distance map which models the distribution of destination schools for Educational Field Practices (PLK) in 2023, Bungus Teluk Kabung District has the furthest distance of 28665.5 meters from the outermost boundary of the sub-district and the shortest distance is 3486.65 meters to the nearest PLK destination school in the surrounding sub-district. This significant distance indicates that there are no PLK destination schools in the sub-district. Similar conditions also occurred in Lubuk Begalung and Pauh Districts. On the other hand, a sub-district that has an estimated minimum distance between PLK points of 0 meters indicates that there is a PLK destination school in the sub-district. This distance of 0 meters indicates that there is a distribution of students doing PLK in the area, so there is no need to worry about the uneven distribution of PLK activities in it. Meanwhile, sub-districts that still have a high minimum distance can be considered for PLK students to choose from.

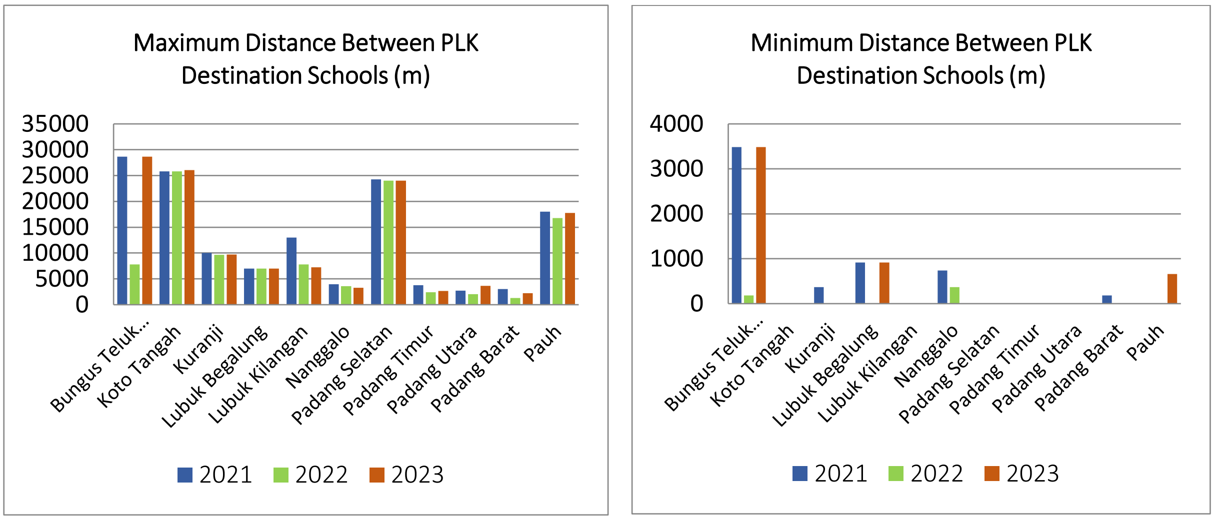

Figure 4. Maximum and Minimum Distance Between Schools PLK Goals (meters) 2021-2023

The diagram above serves to see the differences in PLK distance estimates from 2021-2023 in Padang City, West Sumatra. This map shows the administrative area of Padang City with various sub-districts such as East Padang, Lubuk Begalung, Bungus Teluk Kabung, Pauh, Kuranji and Nanggalo. The red dot symbol indicates the location of schools spread across various sub-districts, while the color of the map which is a gradient from green to red shows the estimated distance of field practice, where areas closer to the school point are marked in green and areas further away are marked in color. red.

The theory related to the distance estimation map for educational field practice is Spatial Mismatch Theory (Andersson et al., 2018), this theory explains how a spatial mismatch between the location of residence and the location of employment opportunities or public services, such as schools, can affect access and educational outcomes. This map can be used to analyze how the geographical distribution of schools in Padang City affects student access to educational facilities. According to Bryan Mann in his 2019 article entitled " The Role of Place, Geography, and Geographic Information Systems in Educational Research ", the use of Geographic Information Systems (GIS) in educational planning has become important for identifying educational infrastructure needs and the geographic distribution of educational facilities. This map is an example of a GIS application in educational planning (Mann & Saultz, 2019). Then, based on research by Rekha et al in 2020 entitled " Spatial accessibility analysis of schools using geospatial techniques " it was found that spatial accessibility analysis of educational facilities using geospatial techniques had been carried out in the city of Tiruchirappalli, Tamil Nadu, India. This research maps the current location of schools along with road networks and sub-districts. The spatial accessibility index is calculated using the Three-Step Floating Catchment Area (3SFCA) method which takes into account Gaussian weights to reduce the problem of excess demand. The results show that 39% of sub-district areas have a lack of educational facilities. The 3SFCA spatial accessibility index and its spatial patterns were compared with the Enhanced Two-Step Floating Catchment Area (E2SFCA) method for validation. The 3SFCA method can reduce demand estimates that are too high in the study area. Difficult to reach locations can reduce the frequency and quality of participation, which in turn can affect student learning outcomes and experiences (Rekha et al., 2020).

To enhance the accessibility and effectiveness of Educational Field Practices (PLK) for Geography Education students in Padang City, several key improvements and programs are proposed. These include developing transportation partnerships and shuttle services for remote schools, integrating Geographic Information Systems (GIS) for accessibility analysis, expanding school partnerships, and conducting awareness campaigns. Establishing a monitoring framework with feedback mechanisms, providing support services such as mentorship and counseling, and building capacity in rural schools through resource investment and infrastructure improvements are essential. Additionally, leveraging technology for mobile learning and online coordination, engaging communities through workshops and service-learning projects, and promoting ongoing research and the sharing of best practices can significantly enrich students' learning experiences and professional development.

Conclusion

The results of the analysis of the distribution and reachability of educational field practice (PLK) locations using the Euclidean distance method to estimate and reflect the direct distance between school locations by measuring the distance of school points (maximum and minimum) from the outer boundaries of the sub-district. The distribution of PLK students in Padang City in 2021 explains that the maximum and minimum distances are in Teluk Kabung District, Kuranji District and Lubuk Begalung District. In 2022, the sub-districts that reflect the closest and furthest distance are Teluk Kabung Sub-district and Nanggalo Sub-district. And in 2023, the reflection of the farthest and closest distances will be in Bungus Teluk Kabung District and Pauh District. Meanwhile, sub- districts that have an estimated minimum distance between PLK points of 0 meters indicate that there are PLK destination schools in the sub-district. This distance of 0 meters explains that there is a distribution of students doing PLK in the sub-district.

References

Andersson, F., Haltiwanger, J. C., Kutzbach, M. J., Pollakowski, H. O., & Weinberg, D. H. (2018). Job displacement and the duration of joblessness: The role of spatial mismatch. *Review of Economics and Statistics*, *100*(2). https://doi.org/10.1162/rest_a_00707

Berthold, M. R., & Höppner, F. (2016). *On Clustering Time Series Using Euclidean Distance and Pearson Correlation*. http://arxiv.org/abs/1601.02213

Boyle, A., Maguire, S., Martin, A., Milsom, C., Nash, R., Rawlinson, S., Turner, A., Wurthmann, S., & Conchie, S. (2007). Fieldwork is good: The student perception and the affective domain. *Journal of Geography in Higher Education*, *31*(2). https://doi.org/10.1080/03098260601063628

Cook, V. (2010). Exploring students' personal experiences of geography fieldwork. *Teaching Geography*, *35*(2).

France, D., & Haigh, M. (2018). Fieldwork@40: fieldwork in geography higher education. *Journal of Geography in Higher Education*, *42*(4). https://doi.org/10.1080/03098265.2018.1515187

Fuller, I., Edmondson, S., France, D., Higgitt, D., & Ratinen, I. (2006). International perspectives on the effectiveness of geography fieldwork for learning. In *Journal of Geography in Higher Education* (Vol. 30, Issue 1). https://doi.org/10.1080/03098260500499667

Huang, R., Cui, C., Sun, W., & Towey, D. (2020). Poster: Is Euclidean Distance the best Distance Measurement for Adaptive Random Testing? *Proceedings - 2020 IEEE 13th International Conference on Software Testing, Verification and Validation, ICST 2020*. https://doi.org/10.1109/ICST46399.2020.00049

Kent, M., Gilbertson, D. D., & Hunt, C. O. (1997). Fieldwork in geography teaching: A critical review of the literature and approaches. In *Journal of Geography in Higher Education* (Vol. 21, Issue 3). https://doi.org/10.1080/03098269708725439

Knowles, D., & Gao, G. (2023). Euclidean Distance Matrix-Based Rapid Fault Detection and Exclusion. *Navigation, Journal of the Institute of Navigation*, *70*(1). https://doi.org/10.33012/NAVI.555

Larkin, H., & Watchorn, V. (2012). Changes and challenges in higher education: What is the impact on fieldwork education? *Australian Occupational Therapy Journal*, *59*(6). https://doi.org/10.1111/1440-1630.12002

Liu, D., Mansour, H., Boufounos, P. T., & Kamilov, U. S. (2018). Robust sensor localization based on Euclidean distance matrix. *International Geoscience and Remote Sensing Symposium (IGARSS)*, *2018-July*. https://doi.org/10.1109/IGARSS.2018.8517324

Mann, B., & Saultz, A. (2019). The Role of Place, Geography, and Geographic Information Systems in Educational Research. *AERA Open*, *5*(3). https://doi.org/10.1177/2332858419869340

Mesquita, D. P. P., Gomes, J. P. P., Souza Junior, A. H., & Nobre, J. S. (2017). Euclidean distance estimation in incomplete datasets. *Neurocomputing*, *248*. https://doi.org/10.1016/j.neucom.2016.12.081

Rekha, R. S., Radhakrishnan, N., & Mathew, S. (2020). Spatial accessibility analysis of schools using geospatial techniques. *Spatial Information Research*, *28*(6). https://doi.org/10.1007/s41324-020-00326-w

Stoyanova-Petrova, S. (2011). An Experience Using Performance-Centered Mobile Learning to Enhance Fieldwork Education. *International Journal of Advanced Corporate Learning (IJAC)*, *4*(4), 43. https://doi.org/10.3991/ijac.v4i4.1727

Vácha, Z., & Ditrich, T. (2021). Impact of fieldwork education on performing cognitive and affective objectives in pupils at primary schools. *E-Pedagogium*, *21*(1). https://doi.org/10.5507/epd.2020.021

Wright R, H. K. (2019). *2 Challenges and Recommendations for Rural Field Education: A Review of the Social Work Literature*.

Zahl-Thanem, A., & Rye, J. F. (2024). Spatial inequality in higher education: a growing urban–rural educational gap? *European Sociological Review*. https://doi.org/10.1093/esr/jcae015

Zhang, L., Jia, Q., Liu, S., Ruan, L., & Long, Y. (2019). New patterns for geography field practice education based on location services. *Abstracts of the ICA*, *1*. https://doi.org/10.5194/ica-abs-1-432-2019