

## Optimizing the Rope Competence of Civil Servant Candidates at the Surabaya Class A Search and Rescue Office through Knot Training

M. Aulia Andhika Putra<sup>1</sup>, Riga Mardhika, S.Pd., M.Or.<sup>2</sup>

<sup>1</sup> PGRI Adi Buana Surabaya, Surabaya, Indonesia



DOI :-

### Sections Info

#### Article history:

Submitted: October 23, 2025

Final Revised: November 11, 2025

Accepted: November 16, 2025

Published: December 31, 2025

#### Keywords:

Rope Competence

Rescue

Knot Training

### ABSTRACT (9 pt, italic, 1 spacing)

**Objective:** The technical competence of BASARNAS personnel, particularly in rescue operations requiring precise rope and knot handling. **Method:** Employing a quantitative approach, the research utilized a paired sample t-test to compare participants' performance before and after the training intervention. A total of 8 personnel participated in the training, with assessments conducted through standardized pre-test and post-test instruments. **Results:** The results revealed a significant improvement in participants' abilities, with the average post-test score rising to 92.50 from a pre-test score of 36.25. The t-statistic value of 4.7098937 exceeded the two-tailed t-critical value of 2.3646243, confirming the statistical significance of the training's impact ( $p < 0.05$ ). These findings underscore the effectiveness of knot training in strengthening operational readiness and professionalism among BASARNAS personnel. **Novelty:** The novelty of this study lies in its empirical validation of a targeted technical intervention within a high-stakes emergency response context. It also offers strategic recommendations for scaling and modernizing training delivery, including the integration of field simulations and digital learning modules. This research contributes to the broader discourse on capacity-building in disaster response agencies and highlights the importance of continuous, context-relevant technical training.

## INTRODUCTION

The National Search and Rescue Agency (BASARNAS) is a non-ministerial government agency with a strategic mandate to conduct search and rescue (SAR) operations throughout Indonesia. In carrying out their duties, BASARNAS personnel are faced with a variety of complex and high-risk operational environments, such as mountainous areas, waters, and post-disaster urban areas. Therefore, mastery of technical skills such as rope and knot skills is a basic competency required for all SAR personnel.

In East Java, particularly Surabaya, various emergency incidents have demonstrated the importance of node skills in rescue operations. According to data from Basarnas' Quick Response SAR, during the period January–July 2025, 125 evacuation and emergency incidents were recorded, including house fires, vehicle evacuations, and rescues. In some cases, such as evacuating victims from burning multi-story buildings and evacuating vehicles that have plunged into rivers, knotting techniques are used to secure the evacuation rope and lift the victim or object vertically.

Additionally, activities like the Surabaya SAR Challenge, organized by the Surabaya SAR Office, feature SAR skills competitions, including basic knotting and Mechanical Advantage System (MAS) tests as part of the rescuer competency evaluation.

These activities demonstrate that knotting is not just a technical skill, but also an indicator of personnel preparedness in emergency situations.

Knots are a basic technique in rigging systems used to tie, connect, or secure ropes in various rescue situations. Knots such as the bowline, clove hitch, figure-eight, and prusik have specific functions in vertical evacuation operations, water rescue, and field security. Mistakes in knotting can have fatal consequences, such as failed evacuations, injury to victims, or even endanger the safety of search and rescue (SAR) personnel. Therefore, intensive and applicable knot training is essential to improve the effectiveness and safety of BASARNAS personnel.

According to Technical Instructions for Basic Search and Rescue Training Number 4 of 2022, basic SAR training focuses on developing three core competencies: general knowledge of SAR, technical search and rescue skills, and strengthening organizational values and character as SAR personnel. One of the technical training materials included in the curriculum is the High Angle Rescue Technique (HART), which directly relates to the use of knots in vertical evacuation. However, in practice, knot training is often only a small part of the curriculum and does not receive sufficient time for intensive practice and technique personalization based on the operational field. Therefore, knot training for BASARNAS Surabaya personnel is a relevant form of community service and has a direct impact on increasing human resource capacity in the SAR field.

Theoretically, training as a systematic and planned process is a recurring theme across definitions. Many scholars emphasize that training involves "a planned conscious effort by organization to help acquire the knowledge, skills and abilities and behaviors related to work" (Al-Hawary et al., 2017). This systematic nature distinguishes training from informal learning, as it represents "a planned intervention by an organization to improve an employee's job-related competencies" (Anvari, 2017). In the educational context, training programs should focus on acquiring new knowledge, competencies, and skills to improve educator performance rather than being viewed as opportunities for external benefits (Zindi et al., 2023). Effective training programs are characterized by their ability to meet intended objectives and produce measurable results (Sajjadi et al., 2020).

In the context of SAR, node training is included in the category of substantive technical training that aims to develop core and supporting competencies for SAR personnel. The learning approach used in this training refers to constructivist theory (Vygotsky, 1978), which emphasizes the importance of active participant involvement in the learning process through social interaction and the zone of proximal development. In addition, an experiential learning approach (Kolb, 1984) is used to ensure that participants gain hands-on experience through the learning cycle: concrete experience, reflection, conceptualization, and active experimentation. Experiential learning operates on several fundamental principles that distinguish it from traditional educational approaches. At its core, experiential learning is learner-centered and operates on the premise that individuals learn best by experience, often described simply as "learning by

doing" (Olaniyi, 2015). However, this "doing" involves much more than simple activity - it requires active participation where the learner becomes a participant rather than a spectator in the learning process (Mulder et al., 2008). Experiential learning generates substantial benefits for learners across multiple dimensions of development. One of the most significant advantages is the strong motivation to learn that comes from student engagement in authentic learning experiences and immediate feedback (Dernova, 2015). This motivation extends beyond knowledge acquisition to skill application, with research showing that experiential learning motivates students not only in gaining knowledge but also in applying skills to real projects, sometimes even inspiring them to pursue careers in related areas (Jonathan et al., 2019).

The node training was designed to address the actual needs of BASARNAS Surabaya personnel through participatory and real-world methods. This activity involved students as facilitators, supervising lecturer as academic director, and BASARNAS CPNS personnel as participants. The training locations were chosen strategically, such as Search and Rescue Office rappelling tower Class A Surabaya, so that participants can practice in conditions that resemble real operational fields.

Thus, the node training serves not only as a community service activity but also as an academic contribution to the development of a more applicable and sustainable SAR training curriculum. This article aims to document the training process, evaluate its results, and provide recommendations for future SAR training development.

## RESEARCH METHOD

This node training was conducted using an intensive, simulation-based practical approach over a full day in the Class A Search and Rescue Office training tower Surabaya from 08.00 to 15.00 WIB, and was attended by eight active CPNS personnel from National Search and Rescue Agency of Surabaya. The selection of participants is based on the background of participants who do not yet have basic experience in search and rescue (SAR) operations, so that training is focused on basic technical skills and the effectiveness of knot use in rescue situations.

The series of activities began with an opening session and briefing by the implementing team, who explained the training objectives and activity scenarios. This was followed by a pre-test to determine participants' theoretical understanding of basic knotting techniques. After completing the pre-test, participants continued with material that began with an introduction and hands-on practice of the most relevant basic knotting techniques for SAR purposes, such as the bowline, clove hitch, figure eight, and prusik. Each participant practiced repeatedly with guidance from a facilitator to ensure technique accuracy. After that, the activity moved on to a vertical evacuation simulation, where knots are used to safely lift or lower loads. In this simulation, participants were faced with limited time conditions to test their dexterity and knot stability.

After the lunch break, participants participated in a rescue scenario involving a victim from the second floor of a building, which required the use of a combination of

knots and anchor systems. This activity was designed to mimic situations frequently encountered in Surabaya's urban search and rescue (SAR) operations, based on several evacuation cases from burning buildings and confined spaces. Knotting skills were evaluated at the end of the activity through a post-test based on the material and practices presented. Pre-test and post-test assessments serve as fundamental tools for evaluating training effectiveness. Analysis of pre-test and post-test scores is essential for assessing learning growth, evaluating intervention impact, establishing baselines, identifying learning needs, supporting evidence-based decision-making, and ensuring research validity (Avianti et al., 2023).

The data analysis technique uses a paired sample t-test to see whether there is a significant difference before and after the node training through the results of the pre-test and post-test that have been completed by the participants.

## RESULTS AND DISCUSSION

### *Results*

Table 1 presents the descriptive statistics for the variables included in this study. The summary includes measures of central tendency (mean and median) and dispersion (standard deviation, minimum, and maximum values), providing an overview of the data distribution and variability across the sample. These statistics offer initial insights into the characteristics of the dataset and serve as a foundation for subsequent inferential analyses. Notably, the mean values indicate general trends, while the standard deviations reflect the extent of variation within each variable.

**Table 1.** Descriptive Statistics

	N	Minimum	Maximum	Mean	Standard Deviation
Pre-Test	8	0.00	90.00	36.25	32.49
Post Test	8	90.00	100.00	92.50	4.63

Based on the table 1, there are 8 participants who have participated in the node training and completed the pre- and post-tests. The minimum pre-test score is 0 and the maximum score is 90 with an average score of 36.25 and a standard deviation of 32.49. A high standard deviation indicates data spread or has a wide variation from the average value. Meanwhile, the post-test results show a lower data spread with a standard deviation of 4.63, where the minimum post-test score is 90 and the maximum score is 100 with an average score of 92.50.

Table 2 displays the results of the paired sample t-test conducted to examine the mean differences between the two related groups. This analysis was performed to determine whether there is a statistically significant change in the measured variable before and after the intervention (or between two conditions). The table includes mean scores, standard deviations, mean differences, t-values, degrees of freedom (df), and significance levels (p-values). A p-value less than 0.05 indicates a significant difference

between the paired observations, suggesting that the intervention or condition had a measurable impact.

**Table 1.** Paired Sample T-Test

	<i>Post Test</i>	<i>Pre-Test</i>
Mean	92.5	36.25
Variance	21,428571	1055,3571
Observations	8	8
Pearson Correlation	-0.2137411	
Hypothesized Mean Difference	0	
df	7	
t Stat	4,7098937	
P(T<=t) two-tail	0.0021831	
t Critical two-tail	2.3646243	

The results of the paired sample t-test showed that the t statistic was 4.7098937. This figure is above the two-tailed critical t value of 2.3646243, which indicates that there is a significant difference between the post-test and pre-test results, where the average post-test result was 92.50, much higher than the average pre-test score of 36.25.

The average pre-test score of 36.25 indicates that participants' understanding and skills in knotting techniques were relatively low before the training. Conversely, the average post-test score of 92.50 reflects a significant improvement after the training. This 56.25-point difference demonstrates that the training is not only statistically effective but also practically relevant in the operational context of BASARNAS.

### **Discussion**

Knot training is a crucial component in strengthening the technical capacity of BASARNAS personnel, as these skills are used in various rescue scenarios, such as vertical evacuation, handling victims in difficult terrain, and securing operations during disasters. The ability to create and use rope knots correctly and efficiently can determine the success of a rescue mission and the safety of the team and victims.

The improved post-test results indicate that the training methods used—both in terms of material delivery, hands-on practice, and evaluation—successfully improved participant competency. This supports previous findings that field-based training is more effective in developing technical skills than purely theoretical approaches.

Overall, these results provide empirical evidence that the designed and implemented node training was highly effective in improving personnel's preparedness and technical skills. Therefore, similar training needs to be continuously developed and replicated across BASARNAS's various work areas to ensure equitable and sustainable competency standards.

These positive results are due to the participants' high level of enthusiasm, as they were able to understand the function and application of each node. The material provided was tailored to operational needs in the field, thus the training was deemed

highly beneficial by the participants and provided them with valuable tools for carrying out their duties as part of the BASARNAS team.

This training used an experiential learning approach that emphasizes learning through direct experience (Kolb, 2014), as well as a social constructivist approach that supports learning through interaction and reflection (Vygotsky, 2012). Despite being implemented in a short time, the evaluation results showed that the one-day training with a focus on direct practice was able to have a positive impact on the skills of CPNS BASARNAS personnel, and has the potential to become a technical training model that can be replicated periodically to increase the capacity of SAR human resources in other regions.

## CONCLUSION

Based on the results of the paired sample t-test analysis, it can be concluded that the knot training provided to BASARNAS personnel significantly improved the participants' abilities. The t-statistic value of 4.7098937, which exceeds the two-tailed t-critical of 2.3646243, indicates that there is a significant difference between the pre-test and post-test results. The average post-test score of 92.50 is much higher than the pre-test score of 36.25, indicating the effectiveness of the training in improving participants' knowledge and technical skills. Knot training has proven to be an appropriate intervention in supporting the preparedness and professionalism of BASARNAS personnel, especially in facing rescue situations that require precise and safe rope and knot skills.

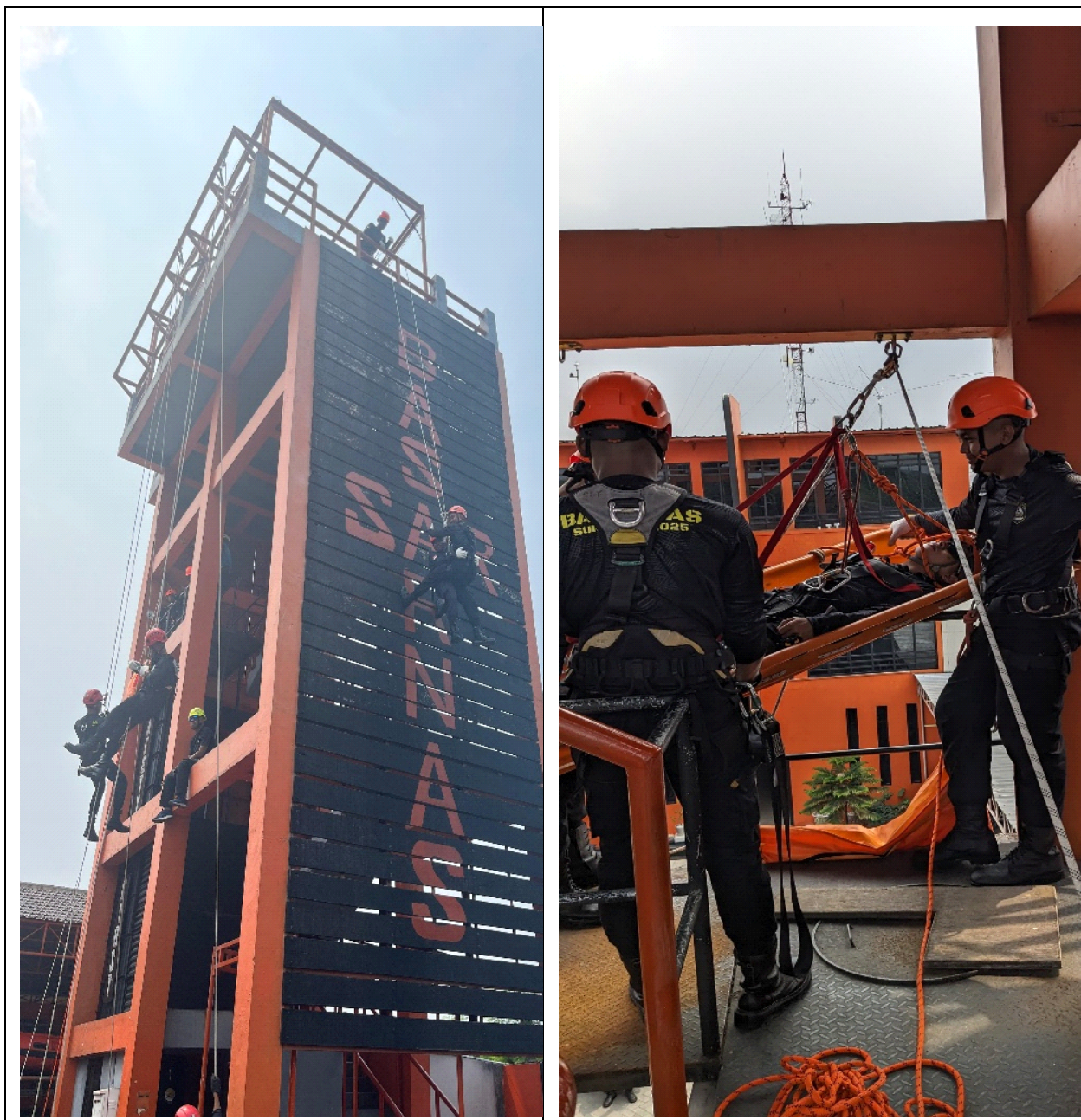
Based on these findings, it is recommended that node training, which has proven effective in improving the technical competence of BASARNAS personnel, be replicated periodically across all work areas. This is crucial to ensure equitable skill standards across operational units. Furthermore, training materials need to be continuously strengthened and updated to remain relevant to developments in modern rescue techniques. Training should also be integrated with field simulations that mimic real-world conditions, allowing participants to hone their skills in more complex and dynamic contexts. To expand access and effectiveness of learning, the development of digital-based training modules such as video tutorials and interactive simulations should also be considered as part of a comprehensive BASARNAS personnel capacity-building strategy.

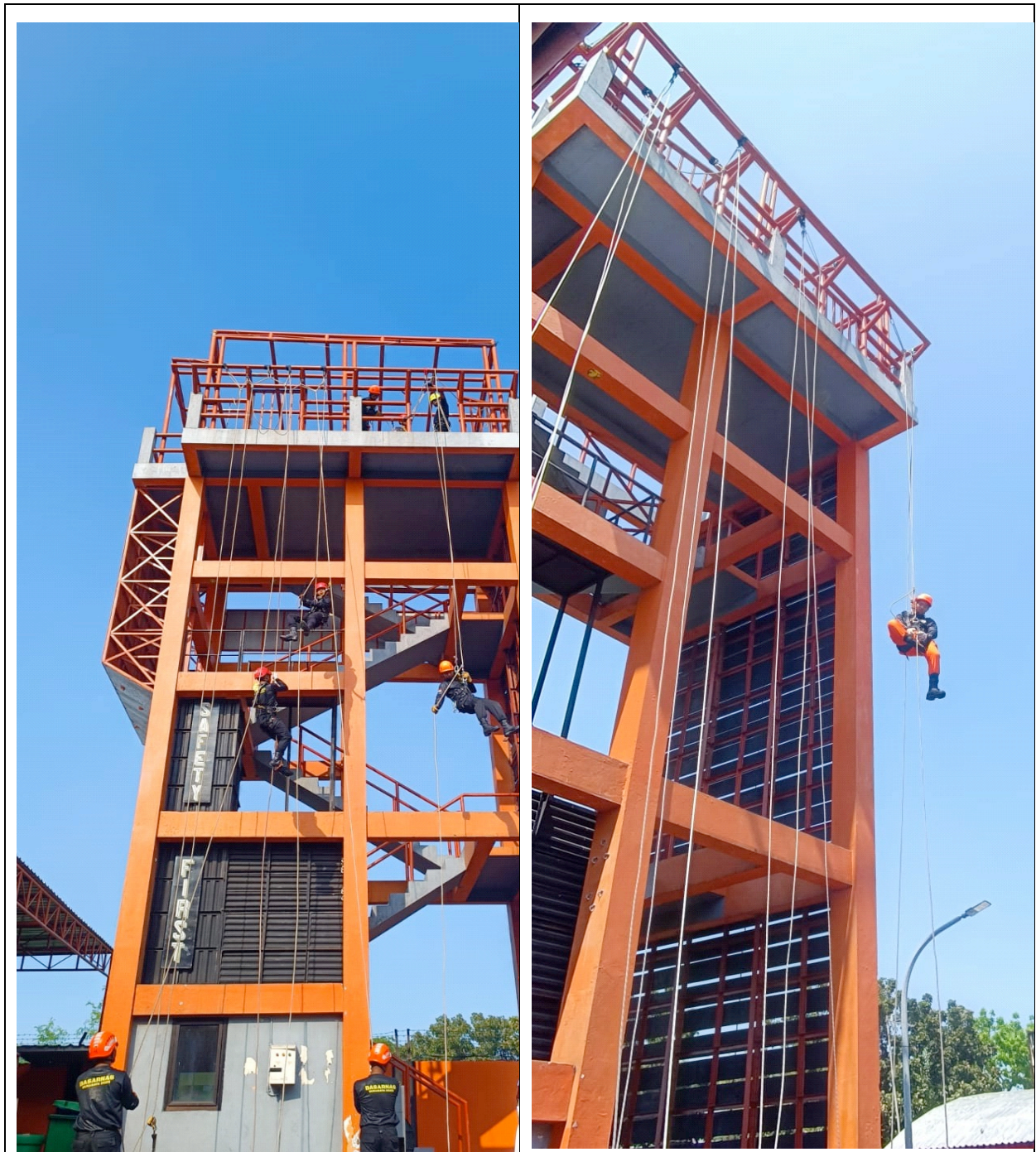
Attachment :

Node Training Documentation









## ACKNOWLEDGEMENTS (OPTIONAL)

Acknowledgements of people, grants, funds, etc should be placed in a separate section not numbered at the very end of the paper.

## REFERENCES

- Badan Nasional Pencarian dan Pertolongan, Quick Response SAR – Sistem Informasi Pencarian dan Pertolongan, Jakarta, Indonesia: Basarnas, 2022. [Online]. Available: <https://qrsar.basarnas.go.id>

- Badan Nasional Pencarian dan Pertolongan, *Petunjuk Teknis Pelatihan Dasar Pencarian dan Pertolongan Nomor 4 Tahun 2022*, Jakarta, Indonesia: Basarnas, Oct. 2022.
- S. I. S. Al-Hawary, Z. H. Al-Kumait, and A. A. Al-Menhaly, "Training programs and their effect on the employees' performance at King Hussain Bin Talal Development Area," *International Journal of Academic Research in Economics and Management Sciences*, vol. 6, no. 1, pp. 1–15, 2017, doi: 10.6007/IJAREMS/v6-i1/2711.
- A. R. Anvari, "Providing the applicable model of training needs assessment in organizations," *Marketing and Branding Research*, vol. 4, no. 1, pp. 1–15, 2017, doi: 10.33844/MBR.2017.60393.
- B. Zindi and M. M. Sibanda, "Relationship between training effectiveness and educator performance in the Eastern Cape Department of Education, South Africa," *Journal of Social Sciences*, vol. 6, no. 3, pp. 87–103, Oct. 2023, doi: 10.52326/jss.utm.2023.6(3).07.
- S. A. Sajjadi, G. Vaysi, and A. A. Khoshgoftar Moghadam, "Effectiveness components of the curriculum of undergraduate course of elementary education in Farhangian University," *Iranian Evolutionary Educational Psychology Journal*, vol. 2, no. 4, pp. 239–248, Dec. 2020, doi: 10.29252/ieepj.2.4.239.
- L. S. Vygotsky, *Mind in Society: The Development of Higher Psychological Processes*, M. Cole, V. John-Steiner, S. Scribner, and E. Souberman, Eds. Cambridge, MA: Harvard University Press, 1978.
- D. A. Kolb, *Experiential Learning: Experience as the Source of Learning and Development*, Englewood Cliffs, NJ: Prentice Hall, 1984
- F. O. Olaniyi, "The relevance of learning theories in adult and non-formal education," *Journal of Educational and Social Research*, vol. 5, no. 1, pp. 261–268, Jan. 2015, doi: 10.5901/jesr.2015.v5n1p261.
- M. A. T. Mulder and D. DeGraaf, "Urban growth, community, and the environment: An experiential pedagogy," *Cities and the Environment (CATE)*, vol. 1, no. 1, Article 2, pp. 1–18, Jan. 2008. [Online]. Available: <https://digitalcommons.lmu.edu/cate/vol1/iss1/2>
- M. Dernova, "Experiential learning theory as one of the foundations of adult learning practice worldwide," *Comparative Professional Pedagogy*, vol. 5, no. 2, pp. 52–57, Jun. 2015, doi: 10.1515/rpp-2015-0040.
- L. Y. Jonathan and M. N. Laik, "Using experiential learning theory to improve teaching and learning in higher education," *European Journal of Social Sciences*, vol. 6, no. 1, pp. 123–132, Apr. 2019, doi: 10.26417/ejser.v6i1.p123-132.
- W. Avianti and E. Pitaloka, "Evaluation of education and training in Ministry of Public Works and Public Housing," *International Journal of Business, Law, and Education*, vol. 4, no. 2, pp. 383, 2023.

**\*M. Aulia Andhika Putra**

Departement of Physical Education Faculty of Teaching,  
PGRI Adibuana Surabaya Unversity,  
Jl. Dukuh Menanggal XII, Surabaya, East Java, 60234, Indonesia  
Email: [andhikacanoeing2000@gmail.com](mailto:andhikacanoeing2000@gmail.com)

**Riga Mardhika, S.Pd., M.Or**

Departement of Physical Education Faculty of Teaching,  
PGRI Adibuana Surabaya Unversity,  
Jl. Dukuh Menanggal XII, Surabaya, East Java, 60234, Indonesia  
Email: [riga@unipasby.ac.id](mailto:riga@unipasby.ac.id)