

Project-Based STEAM Learning in Non-Formal Vocational Education: Occupational Korean Proficiency and Delayed Work-Culture Understanding

Lutfi Ariefianto¹, Rody Putra Sartika², Nurul Faizah³

¹ Universitas Jember, Jember, Indonesia

² Universitas Tanjungpura, Pontianak, Indonesia

³ Ankara University, Ankara, Türkiye

*Corresponding author: lutfi@fkip@unej.ac.id

Submitted: Januari 14, 2026. Revised: March 15, 2026. Accepted: July 15, 2026.

Abstract

Background – Indonesia's Government-to-Government employment scheme with South Korea requires prospective migrant workers to use occupational Korean and understand workplace practices, yet training often prioritizes vocabulary and examination preparation.

Research Urgency – Evidence on project-based STEAM learning in non-formal vocational language training remains limited. Authentic workplace practice is needed to align training with industrial communication and cultural expectations.

Research Objectives – This study examined occupational Korean proficiency and delayed work-culture understanding under project-based STEAM and conventional instruction.

Research Method – A quasi-experimental non-equivalent control-group design involved 54 trainees in Jember. The control group ($n = 26$) received conventional instruction, whereas the experimental group ($n = 28$) completed an eight-week STEAM program. Occupational Korean was assessed immediately after instruction; work-culture understanding was measured at baseline and four weeks later. Independent-samples t-tests and ANCOVA were used.

Research Findings – The experimental group reported higher occupational Korean scores ($M = 84.65$ vs. 71.42) and four-week work-culture scores ($M = 86.92$ vs. 68.15), both $p < .001$. Baseline-adjusted ANCOVA indicated a group difference in the delayed work-culture score, $F(1, 51) = 97.14$, $p < .001$, partial $\eta^2 = .656$.

Research Conclusion – Project-based STEAM learning was associated with higher immediate language performance and delayed work-culture understanding. The non-randomized design and incomplete psychometric reporting preclude causal claims.

Research Novelty/Contribution – The study connects occupational Korean with work-culture simulation in non-formal pre-departure education. It offers a context-specific competency model that requires replication with verified measures and complete baseline data.

Keywords: project-based STEAM learning; occupational Korean; delayed work-culture understanding; non-formal vocational education; prospective migrant workers

How to Cite:

Ariefianto, L., Sartika, R. P., & Faizah, N. (2026). Project-Based STEAM Learning in Non-Formal Vocational Education: Occupational Korean Proficiency and Delayed Work-Culture Understanding. *Journal of Nonformal Education*, 12(2), 280-289. <https://doi.org/10.15294/jone.v12i2.59101>

INTRODUCTION

Indonesia's Government-to-Government employment pathway with the Republic of Korea offers important mobility opportunities while placing demanding linguistic and sociocultural requirements on applicants. Under Korea's Employment Permit System, workers must navigate institutional rules, production routines, and asymmetrical workplace relations in addition to passing a Korean-language examination (Kim & Song, 2023; On & Iskandar, 2025). Host-country language and communication are consequential because they shape access to instructions, safety information, services, and everyday interaction (Cho et al., 2023; Lee et al., 2024). Indonesian workers' reported experiences in Korea further show that employment conditions, discrimination, and access to services are intertwined with communication and adaptation (Novrinda & Han, 2022; On & Iskandar, 2025).

Workplace adjustment therefore cannot be reduced to vocabulary knowledge. Sociocultural adaptation is related to job satisfaction and intentions to remain employed (Tsang & Nguyen, 2023), while research in South Korea indicates that host-community support, communication barriers, and institutional conditions shape migrant workers' adaptation (Fahzaria et al., 2024; Ryou & Kim, 2022). Health and medical experiences also show how cultural interpretation and access to support intersect in migrants' daily lives (Cho et al., 2024). Pre-departure education must therefore connect occupational language with the cultural practices through which that language is used, while avoiding fixed or stereotypical representations of Korean workplaces.

Non-formal vocational institutions occupy a strategic position in this preparation. Vocational education can improve labour-market participation, but its value depends on whether curricula and assessment correspond to workplace competence rather than certification alone (Yoana et al., 2024; Vandenberg & Laranjo, 2021). Industry 4.0 also requires training ecosystems to combine technical, communicative, and adaptive capacities (Hearn et al., 2023). Studies in the Journal of Nonformal Education similarly emphasize partnership-based competence, systematic program evaluation, and practice-oriented training design (Akhadi & Shofwan, 2024; Indarathi et al., 2025; Suminar et al., 2024). These priorities are directly relevant to short-cycle preparation for prospective migrant workers.

Language learning is more likely to transfer when learners use the target language to complete meaningful tasks. Technology-enhanced project-based language learning can integrate language, collaboration, digital tools, and socially purposeful products (Dooly et al., 2021; Fikria et al., 2025). Research on Korean learning also shows that learners actively assemble resources beyond formal classrooms (Nishioka, 2023). More importantly for vocational training, work-integrated language learning creates affordances when classroom and workplace practices are deliberately connected (Febring & Henry, 2022). An examination-centred approach with limited industrial interaction is therefore unlikely to develop the pragmatic communication required on a factory floor.

Project-based STEAM learning provides a possible integrative framework. STEAM projects connect disciplinary knowledge through meaningful design problems and can support higher-order thinking when tasks, scaffolding, and assessment are coherently aligned (Diego-Mantecon et al., 2021; Xu et al., 2025). The arts component is particularly relevant to language and cultural interpretation because it invites representation, perspective-taking, and communicative design. Recent reviews further position project-based learning as a structure for linking inquiry, computational or technical reasoning, collaboration, and authentic products (Saad & Zainudin, 2022; Zhang et al., 2024).

Evidence for project-based learning is generally positive but context-dependent. Recent meta-analyses and systematic reviews report improvements in achievement, engagement, computational thinking, and other complex outcomes, while also showing that effects vary with implementation quality, duration, assessment, and discipline (Rehman et al., 2024; Sánchez-García & Reyes-de-Cózar, 2025; Zhang et al., 2024; Zhang & Ma, 2023). Informal STEM projects can also support learning when participation, facilitation, and project design are aligned (Santhosh et al., 2023). However, most evidence comes from schools and universities and does not establish that the same model will improve occupational language and delayed work-culture

understanding among adult trainees in a non-formal pre-departure setting.

The proposed mechanism is grounded in authentic and workplace learning. Authentic environments connect learning and assessment with realistic problems, roles, tools, and employability-related performance (Martínez-Argüelles et al., 2023; Villarroel et al., 2024). Recent vocational research shows that immersive and mixed-reality simulations can support domain knowledge, skills, motivation, and learning participation when instructional design and debriefing are appropriate (Bödding et al., 2025; Kablitz et al., 2023; Mulders et al., 2024; Sellberg & Lindwall, 2026; Thomann et al., 2024). Simulation quality also depends on social embedding and salient task demands rather than surface realism alone (Braunstein et al., 2022; Chernikova et al., 2024). Augmented and simulator-based vocational tasks can extend these principles through guided practice and performance assessment (Candido et al., 2023; Sellberg et al., 2022).

Recent non-formal education studies have applied project, digital, and multimodal models to literacy, equality education, entrepreneurship, and community learning (Darmawan et al., 2025; Firdaus et al., 2026; Ilyas et al., 2025; Sari et al., 2024). Yet little empirical research has combined project-based STEAM, occupational Korean, and work-culture simulation for prospective migrant workers. This study therefore compared project-based STEAM learning with conventional instruction in two intact classes. H1 predicted a higher immediate occupational Korean posttest score in the experimental group. H2 predicted a higher four-week work-culture score after adjustment for the reported baseline score. The second outcome is described as delayed work-culture understanding rather than long-term retention because no immediate post-intervention work-culture score was available.

METHODS

Design

This study used a quantitative quasi-experimental non-equivalent control-group design. Individual random assignment was not feasible because the training institution retained two intact classes. The available record contained an immediate occupational Korean posttest and baseline plus four-week work-culture scores. Baseline descriptive statistics for occupational Korean were not available; therefore, the language analysis is a posttest-only between-group comparison. The delayed work-culture analysis used baseline adjustment. In non-randomized studies, ANCOVA can improve precision but cannot eliminate selection bias; results therefore require cautious associational interpretation (Hedges et al., 2023; Shieh, 2023; Schwarz, 2025).

Setting and Participants

The study was conducted at Kencana Vocational Training Institution in Jember, Indonesia. The population comprised trainees enrolled in the Employment Permit System–Test of Proficiency in Korean preparation program. Purposive selection identified 54 trainees with no previous overseas work experience, similar training schedules, and institutionally judged comparable initial language proficiency. One intact class formed the conventional-instruction control group ($n = 26$), and the other formed the project-based STEAM experimental group ($n = 28$). The source records did not provide participant demographics, an attrition log, or a sample-size calculation. These omissions restrict assessment of baseline equivalence and external validity.

Instructional Conditions

The intervention lasted eight weeks (48 contact hours). Both groups studied the same core occupational Korean topics and received equal scheduled instructional time. The control group completed instructor-led explanation, vocabulary drills, textbook exercises, and examination practice. The experimental group completed collaborative projects addressing factory communication, occupational safety, production flow, numerical tasks, and Korean workplace interaction. Each cycle proceeded from a realistic problem scenario to planning, task performance, production of an artefact or role-play, feedback, and reflection. Table 1 specifies how each STEAM component was operationalized. The available records did not include an independent

fidelity score or evidence concerning instructor equivalence and cross-group contamination.

Table 1. Operational Integration of STEAM in the Experimental Condition

STEAM component	Instructional application and vocational context
Science and technology	Diagnose simulated machine alerts, interpret sensor readings, and explain occupational safety (K3) procedures using technical Korean.
Engineering	Map an assembly-line workflow, identify a production bottleneck, and propose a layout or process solution through collaborative Korean-language tasks.
Arts	Perform and reflect on role-plays involving greetings (insa), situational awareness (nunchi), hierarchy, teamwork, conflict, and fast-paced production (ppalli-ppalli).
Mathematics	Calculate KRW-IDR conversions, overtime pay, deductions, production quantities, and cargo ratios using Korean numerical expressions.

Measures and Measurement Schedule

Occupational Korean proficiency was assessed with a 40-item multiple-choice test covering technical vocabulary, safety instructions, numerical expressions, and workplace dialogues. The source manuscript reported Cronbach's $\alpha = .84$ for this test. Delayed work-culture understanding was assessed with a 25-item Likert-type scale covering hierarchy, communication etiquette, teamwork, discipline, safety, and adaptation to production pace. The scale was administered at baseline and four weeks after the intervention. Because it used self-report items and no immediate post-intervention work-culture score was available, the measure does not independently demonstrate retention of knowledge.

Three experts in non-formal and language education reviewed item relevance and clarity. The source manuscript reported an expert-agreement index of .88; this documents content review but does not by itself establish construct validity. A pilot test involved 20 trainees outside the analytic sample. However, the available records did not specify the Work-Culture Scale response anchors, possible score range, item-level scoring, dimensionality, or its exact α or ω coefficient. Contemporary psychometric guidance recommends reporting the reliability estimator together with its assumptions and evidence for the scale's internal structure (Malkewitz et al., 2023). These values must be retrieved from the original instrument and pilot output before publication; no unverified value is introduced here.

Data Analysis

Data were analyzed in SPSS 26. Group means and standard deviations were summarized. Independent-samples t-tests compared the supplied post-intervention group statistics. Because the t values in the source table were inconsistent with the reported n, M, and SD, equal-variance t statistics, mean-difference confidence intervals, and Hedges' g values were recalculated from those summary data. ANCOVA examined the four-week work-culture score while controlling for its baseline score. Current methodological treatments emphasize that ANCOVA effect estimates, confidence intervals, model assumptions, and design limitations should be reported together (Hedges et al., 2023; Shieh, 2023; Schwarz, 2025). Statistical significance was evaluated at $\alpha = .05$. The raw dataset, adjusted means, and complete diagnostic output were unavailable for independent verification.

Ethical Reporting

The source records available for this revision did not document review by an ethics committee, an institutional permission reference, an approval number, or the procedure used to obtain informed consent. Consequently, this manuscript does not claim verified ethical approval or consent. The authors must insert the approving institution, reference number if applicable, participant-information procedure, consent format, confidentiality safeguards, and right-to-withdraw procedure from the original study records before final publication.

RESULTS AND DISCUSSION

The source manuscript stated that Shapiro–Wilk tests were non-significant ($p > .05$) and reported Levene’s $F(1, 52) = 1.43, p = .237$. It did not provide outcome- and group-specific W statistics, graphical diagnostics, residual statistics, or the homogeneity-of-regression-slopes test required for ANCOVA. The assumption checks therefore cannot be independently verified from the available record.

Table 2 presents the supplied group means and standard deviations together with comparisons reconstructed from those summary statistics. The experimental group had higher reported scores on the immediate occupational Korean posttest and the four-week work-culture measure. These are between-group differences; they do not demonstrate individual improvement because complete baseline distributions were unavailable.

Table 2. Reconstructed Post-Intervention Group Comparisons

Outcome	Control M (SD)	Experimental M (SD)	Reconstructed comparison
Occupational Korean proficiency	71.42 (5.82)	84.65 (4.31)	MD=13.23 [10.45, 16.01]; $t=9.54$; $p<.001$; $g=2.56$ [1.84, 3.28]
Delayed work-culture understanding	68.15 (6.24)	86.92 (4.15)	MD=18.77 [15.90, 21.64]; $t=13.10$; $p<.001$; $g=3.52$ [2.66, 4.37]

Note. MD = experimental minus control mean. Equal-variance t statistics, 95% confidence intervals, and Hedges’ g were reconstructed from the reported n , M , and SD . Effect estimates require verification against the raw dataset.

For occupational Korean proficiency, the reconstructed mean difference was 13.23, 95% CI [10.45, 16.01], $t(52) = 9.54, p < .001$, Hedges’ $g = 2.56$, 95% CI [1.84, 3.28]. For delayed work-culture understanding, the reconstructed mean difference was 18.77, 95% CI [15.90, 21.64], $t(52) = 13.10, p < .001$, Hedges’ $g = 3.52$, 95% CI [2.66, 4.37]. These unusually large standardized differences may reflect the intervention, pre-existing class differences, instructor effects, novelty, measurement characteristics, or a combination of these factors.

The supplied ANCOVA output examined the four-week work-culture score after adjustment for the reported baseline score. The baseline covariate was associated with the delayed score, $F(1, 51) = 6.32, p = .015$, partial $\eta^2 = .110$. The adjusted instructional-condition term was also statistically significant, $F(1, 51) = 97.14, p < .001$, partial $\eta^2 = .656$. The source did not provide adjusted group means, their confidence intervals, or the regression-slope diagnostic. The ANCOVA result should therefore be treated as provisional pending raw-data verification.

Table 3. Supplied ANCOVA for Four-Week Work-Culture Understanding

Source	SS (df)	MS	F, p	Partial η^2
Baseline work-culture score	142.18 (1)	142.18	6.32, .015	.110
Instructional condition	2184.65 (1)	2184.65	97.14, <.001	.656
Error	1146.88 (51)	22.49	—	—

Note. The baseline work-culture score was entered as the covariate. The source output reported residual $SS = 1146.88$ and $MS = 22.49$. Adjusted means and confidence intervals were unavailable.

Within this sample, the reconstructed statistics were consistent with H1 and the supplied baseline-adjusted model was consistent with H2. Project-based STEAM learning was associated with higher immediate occupational Korean performance and a higher four-week work-culture score than conventional instruction. This pattern is compatible with recent evidence that well-structured projects integrate content, collaboration, technology, and purposeful performance (Dooly et al., 2021; Fikria et al., 2025; Rehman et al., 2024). Meta-

analytic evidence also shows that project outcomes depend on design and assessment quality (Sánchez-García & Reyes-de-Cózar, 2025; Zhang et al., 2024; Zhang & Ma, 2023). The present findings support further testing of the model; they do not establish universal or causal superiority.

The likely advantage for language mastery was contextual use. Trainees did not only recall technical terms; they used Korean to diagnose alerts, explain safety decisions, calculate production quantities, negotiate task roles, and enact supervisor–worker exchanges. Such tasks can create links between classroom discourse and future work practices, which is central to work-integrated language learning (Febring & Henry, 2022). They also provide multiple modes of representation and feedback, consistent with recent project-based language-learning research (Dooly et al., 2021; Fikria et al., 2025) and learners' self-directed use of digital Korean-language resources (Nishioka, 2023). For learners accustomed to examination preparation, using language as a tool for completing industrial tasks may have made form, meaning, and purpose more mutually reinforcing.

The four-week work-culture difference is educationally plausible but should not be interpreted as proven long-term retention. Authentic assessment and simulation can position knowledge within realistic roles, tools, decisions, and social negotiations (Martínez-Argüelles et al., 2023; Villarroel et al., 2024). Vocational simulations can support situated understanding when task demands are salient and learners receive guidance and debriefing (Braunstein et al., 2022; Chernikova et al., 2024; Kablitz et al., 2023; Sellberg & Lindwall, 2026; Thomann et al., 2024). Repeated role-play and retrieval may also strengthen later access to learned material (Agarwal et al., 2021). Nevertheless, the self-report format, missing coefficient, and absence of an immediate culture posttest prevent a direct claim about retained knowledge.

From a workplace-learning perspective, the intervention created a boundary space between the training institution and the anticipated Korean factory. Safety sheets, production layouts, wage calculations, and interaction scripts connected classroom activity with future occupational participation, consistent with work-integrated language learning (Febring & Henry, 2022). Recent reviews describe workplace learning as dependent on learning goals, access to interaction and feedback, learner agency, and the design of supportive environments (Hemmler et al., 2023; Lokhtina & Faller, 2024; Smet et al., 2022). The project cycles operationalized these conditions through collaborative decisions rather than passive exposure.

The findings also complement recent research on informal workplace learning. Learning behaviours are more likely when work characteristics, individual agency, supervisor support, feedback, and social interaction support experimentation and reflection (Decius et al., 2021; Sijbom et al., 2025; Smet et al., 2022; Wijga et al., 2025). Although the present intervention occurred before employment, it rehearsed these behaviours in a protected environment. This is important because industrial preparation must develop the capacity to seek clarification, interpret feedback, and adjust performance—not merely reproduce fixed phrases.

Cultural preparation should nevertheless avoid treating Korean work culture as homogeneous or static. Concepts such as hierarchy, speed, and collective responsibility are useful only when taught as situational tendencies open to discussion, not as stereotypes. Research on Korea's employment system and migrant adaptation shows that adjustment is jointly shaped by workers' resources, organizational conditions, policy, communication barriers, discrimination, and access to support (Cho et al., 2024; Fahzaria et al., 2024; Kim & Song, 2023; Lee et al., 2024; Novrinda & Han, 2022; On & Iskandar, 2025; Ryou & Kim, 2022). Cross-cultural training is most defensible when it builds interpretive flexibility and communication strategies rather than requiring unilateral conformity (Tsang & Nguyen, 2023).

For non-formal education, the practical implication is a shift from separate language and culture modules toward competency-based projects assessed through observable performance. Existing studies show the value of program evaluation, digital project learning, multimodal entrepreneurship, and community-oriented innovation in non-formal settings (Akhadi & Shofwan, 2024; Darmawan et al., 2025; Firdaus et al., 2026; Ilyas et al., 2025; Indarathi et al., 2025; Sari et al., 2024; Suminar et al., 2024). Training providers could adapt the present matrix to local equipment and job sectors, prepare instructors to facilitate rather than merely lecture, and combine language tests with scenario-based observation. These changes would also align vocational training with industry needs for technical, communicative, and adaptive competence (Yoana et al., 2024; Hearn

et al., 2023; Vandenberg & Laranjo, 2021).

Several limitations constrain interpretation. The study used two intact classes from one institution and did not report demographic equivalence, attrition, a sample-size calculation, instructor equivalence, or intervention fidelity. Baseline occupational Korean statistics were unavailable. The Work-Culture Scale lacked a reported response range, dimensionality, and α or ω coefficient, while its self-report format and measurement schedule did not directly establish retention. The source also lacked verifiable ethics and consent documentation. Raw observations, adjusted means, and complete assumption diagnostics were unavailable, and the reconstructed standardized effects were unusually large. Future studies should use multi-site allocation or matched designs, report complete baseline and follow-up distributions, validate the scale in an adequately sized independent sample, document implementation fidelity, and follow trainees into Korean workplaces using performance tests, supervisor ratings, safety outcomes, and qualitative accounts.

CONCLUSION

In this single-site quasi-experiment, the project-based STEAM class had higher reported immediate occupational Korean scores and higher baseline-adjusted four-week work-culture scores than the conventional class. The instructional model connected technical language with occupational safety, production flow, numerical reasoning, collaboration, and situated workplace communication. The findings identify a promising competency-based approach for further evaluation in non-formal pre-departure vocational education. The design does not establish a causal effect or long-term work-culture retention. Non-random allocation, incomplete baseline reporting, a small institutional sample, incomplete scale psychometrics, missing ethics documentation, and the absence of workplace follow-up limit inference. Broader adoption requires replication with verified instruments, complete raw-data reporting, documented fidelity, longer follow-up, and actual employment outcomes.

REFERENCES

- Agarwal, P. K., Nunes, L. D., & Blunt, J. R. (2021). Retrieval practice consistently benefits student learning: A systematic review of applied research in schools and classrooms. *Educational Psychology Review*, 33, 1409–1453. <https://doi.org/10.1007/s10648-021-09595-9>
- Akhadi, D. Y., & Shofwan, I. (2024). Evaluation of the CIPP model of the sewing training program. *Journal of Nonformal Education*, 10(1), 33–48. <https://doi.org/10.15294/jone.v10i1.1723>
- Bödding, R., Schriek, S. A., & Maier, G. W. (2025). A systematic review and meta-analysis of mixed reality in vocational education and training: Examining behavioral, cognitive, and affective training outcomes and possible moderators. *Virtual Reality*, 29, 44. <https://doi.org/10.1007/s10055-025-01118-z>
- Braunstein, A., Deutscher, V., Seifried, J., Winther, E., & Rausch, A. (2022). A taxonomy of social embedding—A systematic review of virtual learning simulations in vocational and professional learning. *Studies in Educational Evaluation*, 72, 101098. <https://doi.org/10.1016/j.stueduc.2021.101098>
- Candido, V., Raemy, P., Amenduni, F., & Cattaneo, A. (2023). Could vocational education benefit from augmented reality and hypervideo technologies? An exploratory interview study. *International Journal for Research in Vocational Education and Training*, 10(2), 138–167. <https://doi.org/10.13152/IJRVET.10.2.1>
- Chernikova, O., Holzberger, D., Heitzmann, N., Stadler, M., Seidel, T., & Fischer, F. (2024). Where salience goes beyond authenticity: A meta-analysis on simulation-based learning in higher education. *Zeitschrift für Pädagogische Psychologie*, 38(1–2), 15–25. <https://doi.org/10.1024/1010-0652/a000357>
- Cho, H.-J., Kang, K., & Park, K.-Y. (2023). Health-related quality of life of migrant workers: A systematic literature review. *BMC Public Health*, 23, 1004. <https://doi.org/10.1186/s12889-023-15981-5>
- Cho, H.-J., Kang, K., & Park, K.-Y. (2024). Health and medical experience of migrant workers: Qualitative meta-synthesis. *Archives of Public Health*, 82, 27. <https://doi.org/10.1186/s13690-024-01254-z>

- Darmawan, D., Hadiyanti, P., Wibowo, S., Syah, R., & Abdillah, M. F. (2025). Development of digital learning media for community-based education: A collaborative innovation and literacy framework. *Journal of Nonformal Education*, 11(2), 289–300. <https://doi.org/10.15294/jone.v11i2.32060>
- Decius, J., Schaper, N., & Seifert, A. (2021). Work characteristics or workers' characteristics? An input-process-output perspective on informal workplace learning of blue-collar workers. *Vocations and Learning*, 14(2), 285–326. <https://doi.org/10.1007/s12186-021-09265-5>
- Diego-Mantecon, J.-M., Prodromou, T., Lavicza, Z., Blanco, T. F., & Ortiz-Laso, Z. (2021). An attempt to evaluate STEAM project-based instruction from a school mathematics perspective. *ZDM–Mathematics Education*, 53(5), 1137–1148. <https://doi.org/10.1007/s11858-021-01303-9>
- Dooley, M., Masats, D., & Mont, M. (2021). Launching a solidarity campaign: Technology-enhanced project-based language learning to promote entrepreneurial education and social awareness. *Journal of Technology and Science Education*, 11(2), 260–269. <https://doi.org/10.3926/jotse.1224>
- Fahzaria, N. A., Suwarsi, S., Fadhila, S. A., & Pebriyanto, W. (2024). Management of cross-cultural communication barriers for Indonesian migrant workers in South Korea. *Komunikator*, 16(1), 81–94. <https://doi.org/10.18196/jkm.21112>
- Febring, L., & Henry, A. (2022). Work integrated language learning: Boundary crossing, connectivity, and L2 affordances. *Migration and Language Education*, 3(1), 1–22. <https://doi.org/10.29140/mle.v3n1.639>
- Fikria, A., Setiawan, S., & Munir, A. (2025). A systematic review of technology-enhanced project-based language learning: Theoretical frameworks, project types, and implications for future research and practice. *F1000Research*, 14, 775. <https://doi.org/10.12688/f1000research.165491.2>
- Firdaus, N. M., Wahyudin, U., Sudiafermana, E., Shantini, Y., & Sava, S. (2026). Project-based learning model in productive digital literacy training. *Journal of Nonformal Education*, 12(1), 1–13. <https://doi.org/10.15294/jone.v12i1.36217>
- Hearn, G., Williams, P., Rodrigues, J. H. P., & Laundon, M. (2023). Education and training for Industry 4.0: A case study of a manufacturing ecosystem. *Education + Training*, 65(8/9), 1070–1084. <https://doi.org/10.1108/ET-10-2022-0407>
- Hedges, L. V., Tipton, E., Zejnnullahi, T., & Diaz, K. G. (2023). Effect sizes in ANCOVA and difference-in-differences designs. *British Journal of Mathematical and Statistical Psychology*, 76(2), 259–282. <https://doi.org/10.1111/bmsp.12296>
- Hemmler, Y. M., Rasch, J., & Ifenthaler, D. (2023). A categorization of workplace learning goals for multi-stakeholder recommender systems: A systematic review. *TechTrends*, 67, 98–111. <https://doi.org/10.1007/s11528-022-00777-y>
- Ilyas, I., Shofwan, I., & Yusuf, A. (2025). Multimodal-based technopreneurship learning model to increase entrepreneurial creativity in equality education. *Journal of Nonformal Education*, 11(2), 247–260. <https://doi.org/10.15294/jone.v11i2.33772>
- Indartha, A. W., Fakhruddin, F., Arbarini, M., Febrianto, R. A., & Agoro, S. (2025). Implementation of the CIPPO evaluation model in culinary training. *Journal of Nonformal Education*, 11(1), 140–152. <https://doi.org/10.15294/jone.v11i1.11015>
- Kablitz, D., Conrad, M., & Schumann, S. (2023). Immersive VR-based instruction in vocational schools: Effects on domain-specific knowledge and wellbeing of retail trainees. *Empirical Research in Vocational Education and Training*, 15, 9. <https://doi.org/10.1186/s40461-023-00148-8>
- Kim, Y. Y., & Song, J. (2023). South Korea's policy for low-skilled migrant workers: Tensions between functional imperatives of the state and their impact on policy coherence. *Journal of International and Area Studies*, 30(2), 93–120. <https://doi.org/10.23071/jias.2023.30.2.93>
- Lee, S. Y., Kim, W. H., & Heo, J. (2024). Migrant well-being and undocumented status in South Korea: A cross-sectional assessment of physical, psychological, social well-being, and health behaviors. *International Journal for Equity in Health*, 23, 38. <https://doi.org/10.1186/s12939-024-02126-2>
- Lokhtina, I. A., & Faller, P. (2024). Rethinking informal workplace learning in times of complexity. *Journal of Workplace Learning*, 36(6), 428–442. <https://doi.org/10.1108/JWL-11-2023-0181>
- Malkewitz, C. P., Schwall, P., Meesters, C., & Hardt, J. (2023). Estimating reliability: A comparison of Cronbach's α , McDonald's ω and the greatest lower bound. *Social Sciences & Humanities Open*, 7(1), 100368. <https://doi.org/10.1016/j.ssaho.2022.100368>

- Martínez-Argüelles, M.-J., Plana-Erta, D., & Fitó-Bertran, À. (2023). Impact of using authentic online learning environments on students' perceived employability. *Educational Technology Research and Development*, 71(2), 605–627. <https://doi.org/10.1007/s11423-022-10171-3>
- Mulders, M., Buchner, J., & Kerres, M. (2024). Virtual reality in vocational training: A study demonstrating the potential of a VR-based vehicle painting simulator for skills acquisition in apprenticeship training. *Technology, Knowledge and Learning*, 29(2), 697–712. <https://doi.org/10.1007/s10758-022-09630-w>
- Nishioka, H. (2023). My Korean language teachers are YouTubers: Learning Korean via self-instruction. *Computer Assisted Language Learning*, 36(3), 346–374. <https://doi.org/10.1080/09588221.2021.1928227>
- Novrinda, H., & Han, D.-H. (2022). Oral health inequality among Indonesian workers in South Korea: Role of health insurance and discrimination factors. *BMC Oral Health*, 22, 22. <https://doi.org/10.1186/s12903-022-02050-3>
- On, T., & Iskandar, K. (2025). Navigating constraints: Indonesian workers' experiences under Korea's EPS. *WILAYAH: The International Journal of East Asian Studies*, 14(1), 50–65. <https://doi.org/10.22452/IJEAS.vol14no1.5>
- Rehman, N., Huang, X., Mahmood, A., AlGerafi, M. A. M., & Javed, S. (2024). Project-based learning as a catalyst for 21st-century skills and student engagement in the math classroom. *Heliyon*, 10(23), e39988. <https://doi.org/10.1016/j.heliyon.2024.e39988>
- Ryou, J., & Kim, S.-Y. (2022). Host people's kindness and migrant workers' cultural adaptation: Evidence from South Korea. *Korea Observer*, 53(4), 713–749. <https://doi.org/10.29152/KOIKS.2022.53.4.713>
- Saad, A., & Zainudin, S. (2022). A review of project-based learning and computational thinking in teaching and learning. *Learning and Motivation*, 78, 101802. <https://doi.org/10.1016/j.lmot.2022.101802>
- Sánchez-García, R., & Reyes-de-Cózar, S. (2025). Enhancing project-based learning: A framework for optimizing structural design and implementation—A systematic review with a sustainable focus. *Sustainability*, 17(11), 4978. <https://doi.org/10.3390/su17114978>
- Santhosh, M. E., Farooqi, H., Ammar, M., Siby, N., Bhadra, J., Al-Thani, N. J., Sellami, A., Fatima, N., & Ahmad, Z. (2023). A meta-analysis to gauge the effectiveness of STEM informal project-based learning: Investigating the potential moderator variables. *Journal of Science Education and Technology*, 32(5), 671–685. <https://doi.org/10.1007/s10956-023-10063-y>
- Sari, E. F., Koda, F., Shofwan, I., & Tyas, D. N. (2024). TPACK-based team-based project learning design in improving digital literacy skills. *Journal of Nonformal Education*, 10(2), 402–413. <https://doi.org/10.15294/jone.v10i2.10988>
- Schwarz, W. (2025). The ANCOVA model for comparing two groups: A tutorial emphasizing statistical distribution theory. *Frontiers in Psychology*, 16, 1600764. <https://doi.org/10.3389/fpsyg.2025.1600764>
- Sellberg, C., & Lindwall, O. (2026). Simulation-based training in professional education: Learning, participation, and instructional design. *Instructional Science*, 54, 9. <https://doi.org/10.1007/s11251-025-09763-2>
- Sellberg, C., Lundin, M., & Säljö, R. (2022). Assessment in the zone of proximal development: Simulator-based competence tests and the dynamic evaluation of knowledge-in-action. *Classroom Discourse*, 13(4), 365–385. <https://doi.org/10.1080/19463014.2021.1981957>
- Shieh, G. (2023). Assessing standardized contrast effects in ANCOVA: Confidence intervals, precision evaluations, and sample size requirements. *PLOS ONE*, 18(2), e0282161. <https://doi.org/10.1371/journal.pone.0282161>
- Sijbom, R. B. L., Koen, J., Peijen, R., & Preenen, P. T. Y. (2025). The impact of workplace changes and supervisor support on employee learning: A nonlinear perspective. *Human Resource Development International*. Advance online publication. <https://doi.org/10.1080/13678868.2024.2401302>
- Smet, K., Grosemans, I., De Cuyper, N., & Kyndt, E. (2022). Outcomes of informal work-related learning behaviours: A systematic literature review. *Scandinavian Journal of Work and Organizational Psychology*, 7(1), Article 2. <https://doi.org/10.16993/sjwop.151>
- Suminar, T., Siswanto, Y., Wardani, S., Yusuf, A., & Islahuddin, I. (2024). Determinant model of graduate competence partnership-based life skills training in the Industry 4.0 era. *Journal of Nonformal Education*, 10(1), 195–209. <https://doi.org/10.15294/jone.v10i1.1658>

- Thomann, H., Zimmermann, J., & Deutscher, V. (2024). How effective is immersive VR for vocational education? Analyzing knowledge gains and motivational effects. *Computers & Education*, 220, 105127. <https://doi.org/10.1016/j.compedu.2024.105127>
- Tsang, S.-S., & Nguyen, T. V. T. (2023). Sociocultural adaptation and job satisfaction as mediators between cultural competence and intention to stay among Vietnamese workers in Taiwan. *Humanities and Social Sciences Communications*, 10, 292. <https://doi.org/10.1057/s41599-023-01798-5>
- Vandenberg, P., & Laranjo, J. (2021). Vocational training and labor market outcomes in the Philippines. *International Journal of Educational Development*, 87, 102501. <https://doi.org/10.1016/j.ijedudev.2021.102501>
- Villarroel, V., Melipillán, R., Santana, J., & Aguirre, D. (2024). How authentic are assessments in vocational education? An analysis from Chilean teachers, students, and examinations. *Frontiers in Education*, 9, 1308688. <https://doi.org/10.3389/feduc.2024.1308688>
- Wijga, M., Beausaert, S., & Kyndt, E. (2025). What drives workplace learning: A systematic review of key antecedents. *Journal of Workplace Learning*, 37(9), 90–113. <https://doi.org/10.1108/JWL-05-2025-0119>
- Xu, T., Ge, X., Gao, Q., & Lu, J. (2025). The impact of STEAM project design on higher-order thinking: A meta-analysis. *Research in Science & Technological Education*, 1–25. <https://doi.org/10.1080/02635143.2025.2533194>
- Yoana, Auwalin, I., & Rumayya. (2024). The role of vocational education on unemployment in Indonesia. *Cogent Education*, 11(1), 2340858. <https://doi.org/10.1080/2331186X.2024.2340858>
- Zhang, L., & Ma, Y. (2023). A study of the impact of project-based learning on student learning effects: A meta-analysis study. *Frontiers in Psychology*, 14, 1202728. <https://doi.org/10.3389/fpsyg.2023.1202728>
- Zhang, W., Guan, Y., & Hu, Z. (2024). The efficacy of project-based learning in enhancing computational thinking among students: A meta-analysis of 31 experiments and quasi-experiments. *Education and Information Technologies*, 29, 14513–14545. <https://doi.org/10.1007/s10639-023-12392-2>