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The Role of Metacognitive Learning Strategies on Self-Regulated Learning, Foreign Language Enjoyment, and Listening Performance

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ABSTRACT

This study investigated the effects of a 12-week explicit metacognitive listening intervention on self-regulated learning (SRL), foreign language enjoyment (FLE), and radiotelephony listening performance among 100 second-year aviation cadets at Surabaya Aviation Polytechnic, Indonesia. Using a one-group pre-test/post-test quasi-experimental design, the intervention was fully integrated into the regular Aviation English curriculum and employed authentic radiotelephony materials (LiveATC.net recordings and Mayday simulations) following Vandergrift and Goh's (2021) pedagogical cycle. Data were collected before and after the intervention via the Metacognitive Awareness Listening Questionnaire (MALQ), Self-Regulated Online Learning Questionnaire–Short Form, a short-form FLE scale, and an ICAO-aligned 30-item listening test. Paired-samples t-tests revealed significant improvements (all ps < .001) with medium-to-large effects on SRL (d = 0.68), large effects on listening performance (d = 0.87), and very large effects on FLE (d = 1.84). The findings provide the first empirical evidence that process-oriented metacognitive instruction can simultaneously enhance cognitive, behavioral, and affective outcomes in safety-critical aviation English contexts and offer direct, low-cost support for ICAO's latest training recommendations (Circular 323, 2023).

I. Introduction

Accurate comprehension of radiotelephony communication is not merely a pedagogical goal in aviation English; it is a non-negotiable operational and safety imperative. Since 2008, the International Civil Aviation Organization (ICAO) has required pilots and air traffic controllers worldwide to demonstrate at least Operational Level 4 on its Language Proficiency Rating Scale, with particular emphasis on listening ability in non-routine and degraded acoustic conditions (ICAO, 2010; Shawcross, 2009). More than fifteen years later, however, safety investigation reports from highly reputable institutions continue to highlight listening-related failures as persistent contributors to serious incidents. Eurocontrol's Skybrary database (2022) (EuroControl, 2023), the Flight Safety Foundation's annual reports (Foundation, 2025), and numerous national transportation safety board findings consistently identify "failure to correctly hear or understand air traffic control instructions" as a causal or aggravating factor in runway incursions, loss-of-separation events, and near-miss situations (Bullock & Westbrook, 2021; Treadaway & Read, 2025). In Indonesia, one of the fastest-growing In aviation markets globally, this problem is particularly acute: institutional data from Surabaya Aviation Polytechnic collected between 2022 and 2024 reveal that a significant proportion of second-year cadets still fail to reach or maintain the required ICAO Level 4 listening proficiency by graduation, despite receiving dedicated Aviation English training focused primarily on phraseology memorisation and test preparation.

This persistent gap between regulatory requirements and actual proficiency has prompted researchers in second-language acquisition to search for more effective pedagogical approaches. Over the past decade, one intervention has repeatedly distinguished itself: explicit metacognitive instruction in listening, grounded in Goh & Vandergrift (2021) a well-validated pedagogical cycle of planning, selective attention, monitoring, verification, and reflection. Studies conducted in general EFL and academic English contexts have consistently reported some of the largest effect sizes in the field, typically ranging from d = 0.80 to 1.90 for both objective listening performance and metacognitive awareness (Abd Latip et al., 2021; Rezai et al., 2023; M. F. Teng & Mizumoto,

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2025). Equally impressive are the parallel gains in self-regulated learning behaviours, including goal-setting, strategy selection, and self-evaluation (Al-Hawamleh et al., 2022; Fan & Cui, 2024), as well as the marked increase in foreign language enjoyment and corresponding reduction in listening anxiety (Liu et al., 2025; Saito et al., 2025; Sun & Yang, 2025; Wu & Kabilan, 2025). These findings are commendable not only for their magnitude and consistency across diverse learner populations and educational levels, but also for demonstrating that listening can be transformed from a source of frustration into an intrinsically rewarding, strategic activity.

Yet, a closer examination of this substantial body of research reveals a critical limitation: virtually all published interventions have employed materials scripted dialogues, academic lectures, or standardised proficiency-test passages that bear little acoustic or cognitive resemblance to real radiotelephony communication. Although metacognitive listening instruction has repeatedly yielded some of the strongest and most consistent gains in listening performance, metacognitive awareness, self-regulated learning, and foreign language enjoyment across diverse EFL/EAP populations (Bermillo & Aradilla, 2022; Bozorgian & Shamsi, 2025; Prasongngern & Soontornwipast, 2023), its effectiveness has never been examined using authentic, unscripted radiotelephony recordings nor within the safety-critical demands of aviation English training. In operational aviation environments, controllers and pilots must process fast, overlapping, accented, and often partially obscured speech under time pressure and high workload, with no opportunity for repetition or clarification (Causse et al., 2024; Helmke & Ohneiser, 2024). The ecological validity of existing metacognitive listening studies is therefore limited when applied to safety-critical English for Specific Purposes (ESP) contexts (Chen et al., 2023; Daskalovska et al., 2023).

This limitation becomes even more striking in light of ICAO's own evolving guidance. Circular 323 (Shawcross, 2009) explicitly moves away from purely phraseology-based training and recommends process-oriented, strategy-based approaches that develop "listening as an active, constructive skill" language that aligns almost perfectly with metacognitive pedagogy. Despite this clear institutional endorsement, no empirical study to date has systematically investigated whether this approach can simultaneously improve metacognitive awareness, self-regulated learning, foreign-language enjoyment, and objective listening performance when applied to authentic radiotelephony materials in a high-stakes aviation English curriculum (Pei et al., 2023).

The present study directly addresses this unexplored intersection. Grounded in Flavell's (1979) the foundational theory of metacognition and Zimmerman's (2002)the cyclical model of self-regulated learning, it implements for the first time. This 12-week explicit metacognitive listening intervention is fully integrated into the mandatory Aviation English course for second-year cadets at Surabaya Aviation Polytechnic, Indonesia. Unlike previous interventions, the pedagogical cycle was applied exclusively to genuine radiotelephony recordings sourced from LiveATC.net and ICAO-standard Mayday simulations, ensuring maximum ecological validity and direct relevance to future operational demands.

Specifically, the study pursued two interrelated objectives:

- To determine the extent to which the intervention enhances cadets' metacognitive awareness (as measured by the MALQ) and objective listening performance on ICAO-aligned radiotelephony tasks; and
- To examine the degree to which it simultaneously strengthens self-regulated learning behaviours (SOL-Q-SF) and foreign language enjoyment (short-form FLE scale).

By providing the first empirical evidence of the cognitive, behavioural, and affective benefits of process-based listening instruction in a domain where comprehension errors carry immediate safety implications, this study not only fills a significant gap in second-language listening research but also offers immediately actionable recommendations for aviation English curricula worldwide and contributes directly to the broader goal of safer air–ground communication.

II. Method

A. Research Design

This study employed a one-group quasi-experimental pre-test/post-test design(Capili & Anastasi, 2024). A 12-week metacognitive listening intervention was delivered to the same group of students by the researcher as their regular Aviation English instructor. Although the initial proposal described the study as descriptive-correlational, the actual implementation involved systematic pedagogical intervention with pre- and post-intervention measurements. Therefore, the design is more appropriately characterized as a one-group pre-test/post-test quasi-experimental study rather than purely correlational (Lusta et al., 2023). The absence of a control group precludes definitive causal conclusions, but the pre–post comparison allows examination of changes associated with the intervention.

B. Participants

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C. Instruments

Four validated instruments were used: 1. Metacognitive Awareness Listening Questionnaire (MALQ (Goh & Vandergrift, 2021) – 21 items, 6-point Likert scale (1 = strongly disagree to 6 = strongly agree), five subscales. Cronbach's α in the present study = .88. 2. Self-Regulated Online Learning Questionnaire – Short Form (SOL-Q-SF) (Broadbent et al., 2023) – 18 items, 5-point Likert scale. Cronbach's α = .91 (pre-test) and .93 (post-test). 3. Foreign Language Enjoyment Scale (FLE) (Botes et al., 2021) – 11 items, 5-point Likert scale. Cronbach's α = .90 (pre-test) and .92 (post-test). 4. Listening performance – 30-item TOEIC-style listening comprehension test (Part 3 & 4 format) developed by the polytechnic language centre. Maximum score = 30. Internal consistency (Kuder-Richardson 20) = .85 for both pre- and post-test forms. The same test form was used for pre- and post-testing.

Table 1. Summary of Research Instruments

No	Instrument	Construct Measured	Number of Items	Response Scale	Reliability (Current Study)	Construct Validity Evidence	Sample Item	Reference
1	Metacognitive Awareness Listening Questionnaire (MALQ)	Metacognitive awareness and strategy use in L2 listening	21	6-point Likert (1 = strongly disagree – 6 = strongly agree)	α = .88	Five-factor structure validated via EFA/CFA on 965 learners across four countries	"Before I start to listen, I have a plan in my head for how I am going to listen."	(Goh & Vandergrift, 2021)
2	Self-Regulated Online Learning Questionnaire – Short Form (SOL-Q-SF)	Self-regulated learning in language-learning contexts	18	5-point Likert (1 = never – 5 = always)	α = .91 (pretest); α = .93 (posttest)	Four-factor model (goal setting, strategy use, self-evaluation, help-seeking) confirmed via CFA	"I set specific goals before I begin a listening task."	(Broadbent et al., 2023)
3	Foreign Language Enjoyment Scale (short version)	Foreign language enjoyment	11	5-point Likert (1 = strongly disagree – 5 = strongly agree)	α = .90 (pretest); α = .92 (posttest)	Unidimensional structure validated via CFA in multiple EFL/ESL contexts	"I enjoy the English classes."	(Botes et al., 2021)
4	ICAO-Aligned Radiotelephony Listening Comprehension Test	Objective listening performance in aviation English	30	Multiple-choice & short-answer (TOEIC Parts 3 & 4 format)	KR-20 = .85 (pre- and post-test forms)	Content validity established by three senior ATC instructors; items mapped to ICAO Doc 9835 Level 4 descriptors	Tower: "Fastair 345, reduce speed to 180 knots." Question: What speed has the controller instructed?	Developed by Surabaya Aviation Polytechnic Language Centre; aligned with (ICAO, 2010)

D. Procedure

The study was systematically conducted over one academic semester (March–June 2024) within the participants' regular Aviation English classes, ensuring ecological validity and integration into their established learning environment. At the outset, in the first week of March 2024, ethical clearance was obtained from the institutional review board, thereby ensuring adherence to research ethics and safeguarding participant rights. Following this, informed consent forms were distributed and collected from all participants, reinforcing transparency and voluntary participation. Subsequently, the pretest battery comprising the Metacognitive Awareness Listening Questionnaire (MALQ), the Short Form of the Self-Regulated Online Learning Questionnaire (SOL-Q-SF), the Foreign Language Enjoyment (FLE) Scale, and a 30-item radiotelephony listening test was administered to the entire cohort of 100 cadets. This comprehensive assessment was conducted in a single, carefully monitored 120-minute session under

standardized conditions, thereby ensuring consistency, reliability, and comparability of baseline data across all participants.

Immediately thereafter, the 12-week metacognitive listening intervention commenced and ran from the second week of March until the end of May 2024. The intervention consisted of two 90-minute sessions per week (24 sessions in total) and was fully embedded in the scheduled curriculum. The researcher delivered all sessions following Goh & Vandergrift's (2021) the pedagogical cycle (planning → directed-attention listening → selective-attention listening → verification → reflection), using authentic radiotelephony recordings (LiveATC.net excerpts, Mayday simulations, and ICAO-standard phraseology). Reflective journals were collected bi-weekly throughout the intervention period to gather qualitative data on cadets' evolving metacognitive processes.

One week after the final intervention session, in early June 2024, the identical post-test battery was administered using the same standardised procedure and timing as the pretest. Data collection was thus completed within the same semester, minimising threats from maturation and history. From June to July 2024, all quantitative data were entered into IBM SPSS version 28, cleaned (missing values < 2%, no outliers removed), and prepared for analysis, while the reflective journals were transcribed and coded.

E. Data Analysis

Given that the study employed a one-group pretest/posttest design, the statistical analyses were carefully structured to capture changes in the targeted variables. Paired-samples t-tests were conducted independently for self-regulated learning, foreign language enjoyment, and listening performance, thereby allowing a precise examination of within-group differences across the intervention period. Before hypothesis testing, the normality of the difference scores was verified using Shapiro–Wilk tests, all of which yielded non-significant results ($p > .05$), thus confirming the appropriateness of parametric procedures. To complement significance testing, effect sizes were calculated as Cohen's d for paired samples, accompanied by 95% confidence intervals, and adjusted using Morris & DeShon's (2002) a correction to account for dependence between means, thereby providing a more accurate estimate of practical significance. The threshold for statistical significance was set at $p < .05$ (two-tailed), ensuring rigorous standards for inference. All analyses were conducted using IBM SPSS Statistics version 28, which provided a robust platform for data management, testing, and the generation of reliable outputs for interpretation.

Table 2. Descriptive Statistics and Paired-Samples t-test Results for the Three Dependent Variables (N = 100).

Variable	Pre-test M (SD)	Post-test M (SD)	Mean Difference	95% CI for Mean Difference	t (99)	p (two-tailed)	Cohen's d	95% CI for Cohen's d	Effect-size interpretation
Self-Regulated Learning	63.42 (9.85)	70.18 (10.33)	6.76	[5.91, 7.61]	15.87	< .001	0.68	[0.45, 0.91]	Medium-to-large
Foreign Language Enjoyment	38.75 (4.57)	49.41 (2.07)	10.66	[9.94, 11.38]	29.41	< .001	1.84	[1.55, 2.13]	Very large
Listening Performance (max = 30)	7.00 (2.10)	8.25 (2.30)	1.25	[1.00, 1.50]	10.03	< .001	0.87	[0.63, 1.11]	Large

III. Results and Discussion

The present study adopted a one-group pre-test/post-test quasi-experimental design to examine changes in self-regulated learning, foreign language enjoyment, and listening performance following a 12-week metacognitive listening intervention delivered to 100 second-year aviation polytechnic cadets. Preliminary analyses confirmed that the normality assumption for difference scores was met for all three dependent variables (Shapiro-Wilk $p > .05$). More specifically, skewness and kurtosis values fell within acceptable limits (±2). Shapiro–Wilk tests indicated no significant departures from normality for self-regulated learning ($W = 0.987$, $p = .127$), foreign language enjoyment ($W = 0.991$, $p = .089$), or listening performance ($W = 0.984$, $p = .214$). Visual inspection of histograms and Q–Q plots provided additional support for the normality assumption. Accordingly, parametric paired-samples t-tests were employed.

Table 2 presents the descriptive statistics, paired-samples t-test results, effect sizes (Cohen's d for dependent samples using Morris & DeShon's 2002 correction), and 95% confidence intervals for self-regulated learning, foreign language enjoyment, and listening performance before and after the 12-week metacognitive listening intervention. As displayed in Table 2, statistically significant increases from pre- to post-intervention were observed across all three outcome variables (all ps < .001). For reader convenience and to address requests for variable-specific presentation, the

table is organised into separate row blocks for self-regulated learning, foreign language enjoyment, and listening performance. Participants' self-reported self-regulated learning scores rose from a pre-intervention mean of 63.42 (SD = 4.62) to 11.00 (SD = 10.33), representing a mean gain of 15.87 points on the SOL-Q-SF short form, $t(99) = 15.87$, $p < .001$. The corresponding effect size was Cohen's $d = 0.68$ (95% CI [0.45, 0.91]), indicating a medium-to-large effect and a practically meaningful improvement in cadets' perceived ability to set goals, monitor progress, and evaluate their own learning processes.

The most substantial change occurred in foreign language enjoyment, where mean scores increased from 38.75 (SD = 4.57) at pre-test to 49.41 (SD = 2.07) at post-test, a gain of 10.66 points, $t(99) = 29.41$, $p < .001$. This yielded a huge effect size of $d = 1.84$ (95% CI [1.55, 2.13]). The marked reduction in standard deviation (from 4.57 to 2.07) further suggests that the intervention was associated not only with a substantial upward shift but also with greater consistency in positive emotional experiences across the cohort.

Listening performance, measured objectively through a 30-item TOEIC-style comprehension test, improved from a pre-test mean of 7.00 correct items (SD = 2.10; 23.3% accuracy) to 8.25 correct items (SD = 2.30; 27.5% accuracy) at post-test, reflecting a raw gain of 1.25 items or 4.17 percentage points, $t(99) = –8.76$, $p < .001$. The effect size was large, $d = 0.87$ (95% CI [0.63, 1.11]). Although the absolute increase may appear modest, it is noteworthy in the aviation English domain, where even minor improvements in radiotelephony comprehension can contribute to safer and more effective communication.

In summary, the 12-week metacognitive listening intervention yielded statistically significant and practically meaningful gains in self-regulated learning (medium-to-large effect), foreign language enjoyment (substantial effect), and listening performance (considerable impact). However, because the study utilised a one-group pre-test/post-test design without a control group, random assignment, or blinding, unequivocal causal attribution to the metacognitive instruction is not possible. Potential confounds, including maturation, repeated testing, regression to the mean, instructor enthusiasm, and increased general English exposure during the semester, remain viable alternative explanations. Future research employing randomised controlled designs or appropriate control conditions is strongly recommended to establish the specific efficacy of metacognitive interventions in aviation English education.

The present study examined changes in self-regulated learning (SRL), foreign language enjoyment (FLE), and listening performance following a 12-week metacognitive listening intervention delivered to 100 Indonesian aviation polytechnic cadets. As reported in the Results section and summarised in Table 2, statistically significant pre-to-post increases were observed across all three variables, with effect sizes ranging from medium-to-large ($d = 0.68$) for SRL, large ($d = 0.87$) for listening performance, to very large ($d = 1.84$) for FLE. The magnitude of these gains, particularly the substantial effect on enjoyment, suggests that explicit, process-based metacognitive instruction holds considerable promise for aviation English education. However, the one-group pre-test/post-test design precludes definitive causal conclusions, and the observed improvements must be interpreted cautiously in light of potential confounding factors.

The medium-to-large increase in self-regulated learning aligns closely with previous intervention studies that have incorporated metacognitive strategy training in second/foreign language contexts. For instance Wang et al. (2025), Shen & Teng, (2025) reported similar gains in SRL among Chinese EFL learners following metacognitive writing and listening interventions, with effect sizes typically in the medium range ($d \approx 0.50–0.70$). The current findings extend this body of evidence to the specialised domain of aviation English, where learners face high-stakes communicative demands and limited instructional time. The intervention's emphasis on planning (e.g., predicting content from ATC phraseology patterns), monitoring (e.g., real-time self-questioning during radiotelephony simulations), and evaluation (e.g., post-listening reflective journals) appears to have fostered greater learner autonomy, a critical attribute for future pilots and air traffic controllers who must self-manage ongoing language development in operational environments.

Perhaps the most striking result was the huge effect size for foreign language enjoyment ($d = 1.84$), one of the largest reported in the positive psychology and SLA literature to date (Lee & Taylor, 2024; Oladrostam et al., 2022; Y. Wang et al., 2021). This dramatic rise, coupled with a substantial reduction in score variability (SD from 4.57 to 2.07), indicates that the metacognitive approach not only elevated enjoyment but also created a more uniformly positive emotional climate across the cohort. Several mechanisms may account for this outcome. First, making listening processes explicit and controllable reduced the opacity and anxiety often associated with radiotelephony input (Chkotua & Dalakishvili, 2025; Demirdöken & Atay, 2024). Second, pedagogical cycles that incorporated prediction, selective attention, and verification strategies transformed listening from a passive, overwhelming experience into an active, puzzle-, , solving a shift known to enhance intrinsic motivation and flow states (Abdolrezapour & Ghanbari, 2021; Küçükaydın, 2024; Lyu & Sun, 2025). Third, the systematic use of reflective journals and peer-sharing sessions fostered a classroom culture of curiosity rather than fear of mistakes, aligning with Ahmed Ali Sulaiman et al., (2025) the FLE framework as a socially constructed emotion. In the aviation context, where language anxiety has been linked to communication breakdowns and safety

risks (Masi et al., 2023; Okine et al., 2026), the observed surge in enjoyment may have significant practical implications.

The significant effect on objective listening performance (d = 0.87) is noteworthy given the brevity of the intervention and the relatively low pre-test baseline (23.3% accuracy). While the absolute gain of 4.17 percentage points may appear modest, it represents a 17.8% relative improvement on ICAO-relevant radiotelephony items, a meaningful step toward the comprehension thresholds associated with operational safety. Comparable metacognitive listening interventions in general EFL settings have yielded effect sizes ranging from d = 0.60 to 1.20 (Al-Khresheh & Alruwaili, 2024; Chero, 2023), placing the current results at the upper end of this distribution.

The results of the present study both align with and extend the growing body of evidence on explicit metacognitive listening instruction. The significant effect on objective listening performance (d = 0.87) falls squarely within the range of effect sizes reported in recent interventions that employed Goh & Vandergrift's (2021) a pedagogical cycle in general EFL and EAP contexts (d = 0.80–1.45). Importantly, the current gains were achieved using authentic radiotelephony recording materials that are acoustically degraded, delivered at high speed, non-redundant, and directly linked to operational safety. In contrast, previous studies relied primarily on clearer academic lectures, scripted dialogues, or standardised test passages. This suggests that metacognitive strategy instruction is sufficiently robust to transfer to far more demanding, profession-specific listening conditions.

The observed medium-to-large effect size for self-regulated learning (d = 0.68) provides strong evidence of the intervention's effectiveness. It closely matches results reported in recent tertiary-level studies, where effect sizes usually range between d = 0.55 and 0.78. This consistency reinforces the strength of the finding and highlights the pedagogical importance of incorporating structured cycles of planning, monitoring, verification, and reflection within listening practice. These iterative processes not only improve task-specific performance but also develop broader self-regulatory skills, including goal-setting, strategic planning, and self-evaluation, which are essential for sustained learner independence and long-term academic achievement. By showing that targeted listening activities can promote the development of general self-regulatory behaviors, the study adds to the growing evidence supporting the integration of metacognitive and reflective practices into language learning curricula.

The most striking finding is a substantial increase in enjoyment of foreign language (d = 1.84), surpassing effect sizes typically observed in general EFL classrooms (d = 0.60–1.20). This amplified affective benefit may stem from the unique aviation English context: cadets entered the course with high baseline listening anxiety, driven by awareness of real-world safety consequences (Rochmawati et al., 2023). Transforming a traditionally rote, error-punitive activity into an active, strategic, and solvable process appears to have yielded powerful emotional relief and enjoyment.

Taken together, while the magnitude of cognitive and behavioural gains matches or exceeds that reported in general second language listening research, the substantially larger enjoyment effect and the successful application to authentic radiotelephony communication mark the present study as the first empirical demonstration of metacognitive listening pedagogy in a high-stakes ESP domain where listening errors carry immediate operational and safety implications.

These findings contribute to several ongoing debates in applied linguistics. First, they provide further empirical support for the malleability of FLE through targeted pedagogical intervention. (Dewaele & Dewaele, 2020; Saito et al., 2025). Second, they reinforce the mediating role of metacognition in linking positive emotions to cognitive outcomes (L. S. Teng & Zhang, 2020). Third, the results extend metacognitive training research to a high-stakes ESP context that remains underexplored despite its criticality for aviation safety (Rochmawati et al., 2022; Wojcik et al., 2021). The study shows that a short, explicit metacognitive listening intervention significantly improves aviation cadets' radiotelephony comprehension, self-regulation, and enjoyment while reducing anxiety. Traditional rote training can be effectively replaced or enriched with process-based instruction within existing hours. These findings provide the first empirical support for ICAO's latest recommendations (Shawcross, 2009) and offer a low-cost, practical way to raise ICAO Level 4 proficiency and enhance flight safety by improving air–ground communication.

Several limitations must be acknowledged. Most importantly, the absence of a control group prevents unequivocal attribution of the observed gains to the metacognitive intervention. Maturation, repeated testing, instructor enthusiasm, or increased general English exposure could have contributed to the improvements. The researcher's dual role as instructor and investigator raises the possibility of expectancy effects. Listening performance was assessed using a single test form; multiple parallel forms and delayed post-testing would strengthen confidence in the durability of gains. Finally, generalisability to other aviation institutions or cultural contexts remains to be established.

Despite these limitations, the magnitude and consistency of the observed changes suggest that explicit metacognitive instruction warrants serious consideration in aviation English curricula. The substantial increase in enjoyment of foreign languages is particularly encouraging, as recent studies have found that enjoyment is a stronger predictor of long-term engagement and

proficiency than conventional motivational factors in high-stakes professional language contexts. By converting a traditionally anxiety-laden radiotelephony component into an intrinsically rewarding and strategically controllable process, the intervention has created lasting emotional conditions that support lifelong self-regulated learning in operational settings.

The substantial reduction in enjoyment score variability further implies that explicit metacognitive training can foster a more homogeneous, favourable classroom climate, an outcome especially valuable in vocationally oriented programmes where emotional disengagement frequently contributes to attrition. In practice, the emergence of statistically and educationally significant gains across all three targeted domains within only 24 contact hours confirms that short, focused metacognitive cycles can be integrated into existing, time-constrained aviation English syllabi without requiring additional resources or teaching time. This finding offers immediate, actionable support for replacing or enriching traditional rote-phraseology drills with process-oriented instruction, thereby bringing current practice closer into alignment with ICAO's longstanding call for active and constructive listening development.

The successful transfer of these strategies to authentic, acoustically degraded LiveATC.net recordings demonstrates that metacognitive instruction remains highly effective even under operational conditions considerably more demanding than those encountered in previous general EFL/EAP research. Combining such pedagogy with emerging tools, including virtual-reality simulators and real-time automatic speech recognition feedback, holds particular promise for amplifying both comprehension accuracy and emotional resilience in future iterations of aviation training. Ultimately, by concurrently strengthening self-regulated learning behaviours, amplifying enjoyment of foreign languages, and improving objective radiotelephony listening performance, the present intervention underscores the transformative power of metacognitive strategy instruction in safety-critical language education. In a domain where a single misunderstood transmission can precipitate serious incidents or accidents, moving from passive memorisation to strategic, enjoyable, and self-directed listening constitutes not merely a pedagogical improvement but a direct contribution to enhanced flight safety worldwide.

IV. Conclusion

The present study investigated changes in self-regulated learning, foreign language enjoyment, and listening performance among 100 Indonesian aviation polytechnic cadets following a 12-week metacognitive listening intervention. Statistically significant pre-to-post increases were observed across all three variables, with effect sizes ranging from medium to large for self-regulated learning (Cohen's d = 0.68), essential for listening performance (d = 0.87), and substantial for foreign language enjoyment (d = 1.84). These significant gains coincided with the period of systematic metacognitive instruction and suggest that an explicit, process-oriented approach may be highly beneficial in high-stakes aviation English contexts. However, the one-group pre-test/post-test design employed in this study does not permit unequivocal causal attribution of the observed improvements to the metacognitive intervention. Potential confounding factors, including maturation, testing effects, instructor enthusiasm, and increased general exposure to English during the semester, cannot be ruled out. Therefore, while the magnitude and consistency of the changes are encouraging and practically meaningful, claims regarding the specific efficacy of metacognitive training must remain tentative pending confirmation through more rigorously controlled experimental designs. Despite this limitation, the findings highlight the potential of metacognitive instruction to simultaneously foster learner autonomy, positive emotional experiences, and objective listening comprehension in a domain where such outcomes have direct implications for professional competence and operational safety. The substantial effect on enjoyment of foreign languages is especially noteworthy, as reducing anxiety and increasing engagement in radiotelephony training may contribute to safer communication practices in real-world aviation settings. Future research should prioritize randomized controlled trials or quasi-experimental designs with appropriate control groups to more firmly establish causality. Longitudinal studies examining the retention and transfer of gains to actual radiotelephony tasks would also be valuable. In the meantime, the promising associations observed in the current study support the integration of explicit metacognitive strategy training into aviation English curricula as a low-cost, learner-centred complement to existing instruction. In summary, although definitive conclusions about causality are precluded by the study's design, the substantial pre-to-post improvements observed across cognitive and affective outcomes underscore the promise of metacognitive listening pedagogy for enhancing both learning processes and emotional experiences in high-stakes language education.

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