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Exchange-Oriented Speaking Practice and Self-Efficacy Pathways In STEM-Infused Language Learning: A Design-Based Synthesis for Reducing Speaking Anxiety and Strengthening Communicative Confidence

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ABSTRACT

Foreign language speaking anxiety is a persistent barrier to oral participation, communicative development, and sustained engagement in second and foreign language learning settings (Ansari, 2015; Bailey, 2020; Bashori et al., 2022). While learners may possess sufficient receptive competence, anxiety can suppress risk-taking and reduce the frequency and quality of speaking practice, thereby restricting opportunities for feedback, interaction, and performance improvement (Bailey, 2020). In teacher education and preservice training contexts, these dynamics become especially consequential because future educators are expected to model communication, facilitate classroom interaction, and create psychologically safe learning environments for their own students (Depaepe & König, 2018; Blackmore et al., 2018). This article synthesizes intervention-oriented evidence on speaking anxiety reduction and integrates it with design-based principles commonly associated with STEM-infused learning experiences. Although the initial prompt foregrounded scientific plant names and semantic motivation, the provided reference set is concentrated on speaking anxiety interventions, instructional design, technology-mediated speaking practice, meta-analytic logic, professional learning, and STEM-oriented pedagogy. Therefore, the present study remains strictly grounded in these references and develops a publication-ready research synthesis that explains how "exchange-oriented practice" (understood as structured interaction, collaborative speaking tasks, and mediated oral exchange) can be designed to reduce anxiety and strengthen speaking confidence through self-efficacy pathways (Bandura, 1997). Using a structured synthesis method aligned with established guidance for interpreting intervention evidence and meta-analytic reasoning, the article identifies design mechanisms—control of practice, audience modulation, supportive feedback, motivational framing, and iterative mastery experiences—that appear repeatedly across effective interventions such as flipped learning, remote speaking tasks, Web 2.0 applications, gamified mobile-assisted learning, and dynamic assessment (Abdullah et al., 2021; Abuhussein et al., 2023; Aktaş, 2023; Ali, 2022; Anton, 2009). The discussion translates these mechanisms into a coherent program model that can be implemented in teacher education and STEM-infused language learning environments to promote durable communicative confidence while acknowledging constraints typical of intervention studies (Desimone, 2009; Arthur Jr. et al., 2001).

Keywords: speaking anxiety; exchange-oriented practice; self-efficacy; STEM-infused pedagogy; teacher education; technology-mediated speaking; instructional design.

INTRODUCTION

Speaking is often treated as the visible "proof" of language competence. In classroom life, speaking becomes a site where learners display developing knowledge under conditions that can feel evaluative, time-bound, and socially exposed. For many learners, the pressure to speak "correctly" and the fear of negative evaluation shape a psychological climate in which speaking is not simply a skill to develop but a risk to manage (Ansari, 2015). Speaking anxiety, in this sense, is not a peripheral affective variable; it is a formative constraint on learning behavior. When anxiety is high, learners may avoid participation, reduce experimentation with new language forms, and withdraw from interaction—even when opportunities for practice are available (Bailey, 2020; Bashori et al., 2022). The result is a feedback loop: less speaking leads to fewer mastery experiences, fewer mastery experiences weaken confidence, weakened confidence makes speaking feel more threatening, and the cycle continues (Bandura, 1997; Bailey, 2020).

The persistence of speaking anxiety has motivated a broad range of pedagogical interventions. The reference set provided for this article includes multiple intervention forms—flipped classroom learning, remote speaking tasks, web-based and Web 2.0 applications, gamified mobile-assisted language learning, voice-based interaction, creative drama, and dynamic assessment—each attempting to reshape the conditions under which speaking occurs (Abdullah et al., 2021; Abuhussein et al., 2023; Aktaş, 2023; Ali, 2022; Azizimajd, 2023; Anton, 2009; Aykac & Cetinkaya, 2013). Although these interventions differ in tools and contexts, they frequently converge on a shared objective: to make speaking practice more frequent, more controllable, less threatening, and more meaningfully connected to learners' goals.

A central theoretical lens capable of unifying these intervention approaches is self-efficacy. Self-efficacy refers to beliefs about one's capability to organize and execute actions required to manage prospective situations (Bandura, 1997). In speaking, self-efficacy affects whether learners attempt to speak, persist when they struggle, recover after errors, and interpret feedback as a route to improvement rather than as evidence of deficiency. Importantly, self-efficacy does not emerge from encouragement alone; it is constructed through experiences—especially mastery experiences—where the learner successfully performs the task under manageable conditions (Bandura, 1997). Therefore, interventions that reduce anxiety and strengthen speaking confidence are often those that systematically increase the probability of mastery experiences by adjusting the design of practice, feedback, and social exposure (Abdullah et al., 2021; Abuhussein et al., 2023; Anton, 2009).

This article also integrates an additional domain present in the reference set: STEM-oriented pedagogical design and preservice teacher education. STEM is frequently linked with integrative learning, real-world relevance, design-based problem solving, and iterative practices of building, testing, revising, and communicating solutions (Bybee, 2010; Blackley & Howell, 2015; Charette, 2015). Within preservice teacher preparation, STEM-focused experiences have been shown to support changes in awareness, pedagogical practices, and professional identity—dimensions that are tightly connected to beliefs about competence (Aslan-Tutak et al., 2017; Berisha & Vula, 2021; Blackmore et al., 2018). While STEM research in the reference set is not explicitly about language learning, it emphasizes design principles (collaboration, iteration, explanation, integration) that are highly compatible with exchange-oriented speaking practice. That compatibility matters because "exchange" in language learning is fundamentally about structured interaction—learners speaking with and through others, negotiating meaning, and using language as a tool for joint activity.

The article's initial title request mentioned "scientific plant names" and "semantic motivation." However, the provided references do not include sources on plant nomenclature, phytonyms, or semantic motivation in botanical naming. Under the constraint "based strictly on the references provided," it would be academically inappropriate to claim evidence about learning scientific plant names or semantic motivation without relevant sources. Accordingly, this article remains strictly grounded in the speaking anxiety, instructional design, self-efficacy, and STEM/preservice teacher education references supplied, and reframes "learning specialized terminology effectively" as a generalizable case of confidence-building in speaking practice rather than as a botanical naming study (Bandura, 1997; Bailey, 2020). If you share plant-name/semantic motivation references, I can produce a second, fully aligned article on that specific topic using those sources only.

Within the bounded scope of the provided sources, this article addresses three research aims:

(1) To synthesize how intervention designs reduce speaking anxiety and strengthen speaking confidence

across technology-mediated and pedagogy-mediated approaches (Abdullah et al., 2021; Bashori et al., 2022; Ali, 2022).

(2) To explain these effects through self-efficacy mechanisms, emphasizing mastery experiences, perceived control, and supportive assessment climates (Bandura, 1997; Anton, 2009).

(3) To translate these mechanisms into a programmatic design model suitable for teacher education and STEM-infused learning environments that depend on collaboration, explanation, and iterative communication (Aslan-Tutak et al., 2017; Bybee, 2010; Depaepe & König, 2018).

METHODOLOGY

The methodological stance of this article is a structured research synthesis informed by meta-analytic reasoning and intervention study interpretation. While the reference list includes works specifically addressing how to conduct meta-analysis (Arthur Jr. et al., 2001) and examples of meta-analytic approaches in education (Bangert-Drowns et al., 2004; Becker & Park, 2011), the present article is designed as a publication-ready synthesis that emphasizes mechanism-based integration rather than numerical aggregation. This approach is especially appropriate when the evidence base includes diverse outcomes, populations, and intervention formats, which can make direct effect-size pooling difficult to justify without additional reporting details (Desimone, 2009; Arthur Jr. et al., 2001).

Evidence identification and inclusion logic. The synthesis uses the provided reference list as the sole evidence universe. Studies and sources were organized into four functional categories:

1. Speaking anxiety interventions and speaking practice designs, including flipped learning, remote tasks, technology-mediated speaking, gamified learning, and related approaches (Abdullah et al., 2021; Abuhussein et al., 2023; Aktaş, 2023; Ali, 2022; Amiryousefi, 2019; Bashori et al., 2022; Azizimajd, 2023; Akdağ-Çimen & Çeşme, 2022; Aydın, 2019).

2. Core conceptual sources on speaking and language pedagogy, used to interpret intervention mechanisms (Ansari, 2015; Bailey, 2020).

3. Theoretical foundations on self-efficacy, used as an explanatory model for confidence development (Bandura, 1997).

4. STEM/preservice education and professional learning design, used to propose an integrative model that fits teacher education settings (Aslan-Tutak et al., 2017; Ayaz & Sarıkaya, 2019; Bakırcı & Karışan, 2018; Berisha & Vula, 2021; Blackley & Howell, 2015; Blackmore et al., 2018; Bybee, 2010; Charette, 2015; Depaepe & König, 2018; Desimone, 2009).

Analytic framework: mechanism coding. Consistent with the idea that impact studies require clear conceptualization of what an intervention consists of and how it operates, the synthesis emphasizes mechanism coding: identifying recurring design features likely to influence anxiety and confidence (Desimone, 2009). Each intervention-oriented source was interpreted through the following mechanism lenses:

- Control of pacing and rehearsal (e.g., the learner's ability to rehearse, repeat, and prepare) (Abdullah et al., 2021; Amiryousefi, 2019).
- Audience modulation and reduced immediate evaluation (e.g., remote tasks, mediated speaking spaces) (Abuhussein et al., 2023; Bashori et al., 2022).
- Feedback climate and assessment framing (e.g., dynamic assessment as supportive evaluation) (Anton, 2009).
- Motivational tone and affective reorientation (e.g., gamification, enjoyment) (Ali, 2022).
- Embodiment and role-based interaction (e.g., TPR/CLT combinations, creative drama) (Akdağ-Çimen & Çeşme, 2022; Aykac & Cetinkaya, 2013).
- Technology affordances (Web 2.0 tools, voice-based tools, online speaking environments) (Aktaş, 2023; Azizimajd, 2023; Bashori et al., 2022).

Interpretive integration with self-efficacy and preservice teacher design. Mechanisms were then interpreted through self-efficacy theory, which explains how mastery experiences, social persuasion, and perceived capability shape behavior under challenge (Bandura, 1997). Finally, the synthesis aligned these mechanisms with teacher

education design considerations and STEM-infused learning practices that stress collaboration and explanation, recognizing that preservice identity development and instructional readiness are influenced by experiences of competence and participation (Blackmore et al., 2018; Depaepe & König, 2018).

Validity considerations in synthesis. The study follows two key cautions highlighted in the reference base. First, intervention evidence should not be interpreted as if "a program" is a single uniform treatment; design features matter, and failure to describe them weakens conclusions (Desimone, 2009). Second, synthesis should attend to heterogeneity: variation across studies can reveal important moderators and contextual dependencies rather than being treated as noise (Becker & Park, 2011; Bangert-Drowns et al., 2004). Therefore, results are presented as a structured descriptive synthesis of patterns, not as claims of a single universal effect.

RESULTS

The synthesis yields a coherent pattern: interventions that reduce speaking anxiety and build speaking confidence are those that systematically increase the availability of mastery experiences while reducing the perceived threat of speaking events. Across the evidence base, the most influential design levers are the structure of practice opportunities, the social conditions of speaking (audience and evaluation), the feedback and assessment climate, and the motivational framing of tasks. These levers converge strongly with self-efficacy pathways (Bandura, 1997).

Practice restructuring through flipped learning and controlled rehearsal. Flipped learning interventions reconfigure the distribution of input, preparation, and performance. Instead of placing first exposure and initial rehearsal inside high-stakes classroom speaking contexts, flipped designs allow learners to engage with content privately and revisit it as needed, with classroom time reserved for more interactive, guided practice (Abdullah et al., 2021; Amiryousefi, 2019). The confidence benefit emerges not merely from "more time" but from a shift in perceived controllability. When learners can prepare, they enter speaking events with reduced uncertainty. Since uncertainty is a frequent fuel for anxiety, increasing predictability through preparation reduces the affective cost of participation (Ansari, 2015; Bailey, 2020).

From a self-efficacy perspective, flipped designs can intensify mastery experiences by increasing the probability that learners will perform adequately in class. If early speaking attempts are successful, learners update their beliefs about capability. This belief shift increases persistence and willingness to attempt more challenging speaking tasks, reducing avoidance behaviors over time (Bandura, 1997). Importantly, the mechanism is sequential: preparation supports early successes; early successes build efficacy; increased efficacy supports more engagement; more engagement supports skill development. Flipped learning thus operates as a structural scaffold for this sequence (Abdullah et al., 2021; Amiryousefi, 2019).

Remote speaking tasks and the reduction of social-evaluative threat. Remote speaking tasks address a core driver of speaking anxiety: fear of negative evaluation in front of peers. When speaking tasks are conducted remotely, learners may experience a different evaluation climate—often less immediate, less socially amplified, and more compatible with rehearsal and revision (Abuhussein et al., 2023). The key mechanism is audience modulation: the social context shifts from public performance to mediated performance. This does not eliminate evaluation, but it changes its timing and tone. Learners can focus on message formulation and clarity rather than on monitoring perceived peer reactions in real time.

Such tasks also enable repetition, which is central to mastery experience formation. When learners can redo a speaking task, they can actively engage in improvement cycles. Each cycle provides evidence of progress, which strengthens self-efficacy (Bandura, 1997). Moreover, repetition reduces novelty; as speaking becomes more routine, the physiological and cognitive arousal associated with anxiety can decline. While anxiety is not "cured" instantly, its intensity can reduce as speaking becomes less exceptional and more habitual (Bailey, 2020; Abuhussein et al., 2023).

Technology-mediated speaking: Web 2.0 tools, web-based learning environments, and voice-based interaction. Multiple sources address technology-mediated speaking practice and its relationship to speaking anxiety. Web-based language learning contexts are associated with speaking anxiety dynamics, suggesting that online environments can either support or complicate affective experience depending on task design and feedback structures (Bashori et al., 2022). Web 2.0 applications can provide mediated speaking opportunities, potentially

reducing anxiety by creating semi-protected spaces for practice, lowering the sense of direct exposure, and supporting repeated engagement (Aktaş, 2023). Voice-based interactions (including chatbot-based speaking) further extend this by offering interactive oral practice where the "partner" is non-judgmental, consistent, and available for repeated attempts (Azizimajd, 2023).

Across these modalities, the mechanism again returns to mastery experiences and perceived safety. Technology can increase frequency of practice because it reduces logistical barriers and can lower embarrassment. When learners practice more often, they build competence; when competence increases, confidence increases; when confidence increases, anxiety decreases (Bandura, 1997; Bailey, 2020). At the same time, technology can introduce new stressors (technical issues, unfamiliar platforms), so effective design requires stable routines, clear guidance, and tasks that emphasize communication rather than perfect performance (Bashori et al., 2022; Desimone, 2009).

Gamified MALL and affective reorientation toward enjoyment. Gamified mobile-assisted language learning has been examined for its impact on speaking enjoyment and speaking anxiety, indicating that motivational tone can be a direct route to anxiety reduction (Ali, 2022). Enjoyment is not merely a pleasant add-on; it changes behavior. When learners experience speaking-related activity as engaging, they practice more, persist longer, and interpret challenges as part of a game-like process rather than as threats to identity. This reframing reduces the emotional cost of making errors, which is a key component of anxiety (Ansari, 2015; Ali, 2022).

From self-efficacy theory, enjoyment can support persistence, and persistence increases opportunities for mastery experiences. Gamified designs thus influence anxiety by changing both affect and exposure: learners feel less threatened and practice more. The combination strengthens competence and confidence (Bandura, 1997; Ali, 2022).

Dynamic assessment and supportive evaluation climates. Dynamic assessment integrates assistance into evaluation, shifting assessment from a purely judgmental event to a developmental process (Anton, 2009). Speaking anxiety often arises when learners anticipate judgment without support. Dynamic assessment counters this by positioning evaluation as mediated learning, which can reduce fear and encourage learners to attempt speech even when uncertain. The mechanism is not simply "gentler grading," but a fundamental change in the meaning of assessment: speaking becomes an opportunity for guided performance improvement rather than a public test of adequacy (Anton, 2009; Bailey, 2020).

Because self-efficacy is sensitive to the interpretation of performance outcomes, dynamic assessment can protect self-efficacy when learners struggle. Instead of interpreting difficulty as evidence of inability, learners can interpret it as a signal of where support is needed. This is crucial for preventing the collapse of confidence after setbacks (Bandura, 1997; Anton, 2009).

Embodied and performative methods: TPR/CLT combinations and creative drama. The evidence base includes approaches that change the embodied experience of speaking, such as TPR and communicative language teaching combinations and drama-based methods (Akdağ-Çimen & Çeşme, 2022; Aykac & Cetinkaya, 2013). These approaches reduce anxiety by moving the learner's attention from self-monitoring to task-based interaction and role performance. Speaking becomes part of action and social exchange rather than an isolated display of correctness. In drama-based speaking, role distance can reduce vulnerability: learners speak "as a role," which can lower fear of personal judgment (Aykac & Cetinkaya, 2013).

These designs also increase repeated speaking opportunities in structured ways, again amplifying mastery experiences and supporting self-efficacy (Bandura, 1997).

STEM-infused learning and preservice teacher development as an enabling environment for exchange-oriented speaking practice. STEM-focused references emphasize collaboration, integration, design-based learning, and identity formation in preservice contexts (Aslan-Tutak et al., 2017; Berisha & Vula, 2021; Blackmore et al., 2018). STEM design experiences often require explaining ideas, defending design choices, negotiating with peers, and presenting outcomes. These are inherently communicative tasks. When such tasks are designed as supportive, iterative exchanges, they can function as confidence-building environments.

In other words, STEM-infused learning creates a natural platform for exchange-oriented speaking because it requires meaningful talk. If language educators and teacher

educators align speaking practice with STEM design tasks—through collaborative explanation, reflection, presentation, and peer feedback—they can create authentic contexts that reduce anxiety by shifting focus to problem-solving and joint activity (Bybee, 2010; Blackley & Howell, 2015; Charette, 2015). Self-efficacy grows when learners see themselves succeeding in meaningful, real-world-like tasks. STEM design provides precisely the kind of context where success feels consequential and identity-building (Bandura, 1997; Blackmore et al., 2018).

DISCUSSION

The results support a core interpretation: speaking anxiety reduction is fundamentally a design outcome. It is not best understood as an internal trait that learners either have or do not have, but as a response to the perceived risks and affordances of the learning environment. When environments are redesigned to provide controllable practice, manageable exposure, supportive feedback, and meaningful exchange, anxiety can decline and confidence can grow (Bailey, 2020; Bashori et al., 2022; Bandura, 1997).

The self-efficacy mechanism as the connective tissue across interventions. Self-efficacy theory clarifies why many seemingly different interventions produce similar outcomes. Flipped learning, remote tasks, gamified practice, Web 2.0 speaking tools, dynamic assessment, and drama-based speaking all increase the probability of successful speaking experiences under tolerable conditions (Bandura, 1997; Abdullah et al., 2021; Abuhussein et al., 2023; Ali, 2022; Anton, 2009). The learner experiences success; success strengthens efficacy; stronger efficacy reduces avoidance; reduced avoidance increases practice; practice improves skill; improved skill stabilizes confidence. This sequence is not automatic, but it is a plausible explanatory chain repeated across the evidence base (Bandura, 1997; Bailey, 2020).

A key implication is that speaking confidence is not only a function of linguistic knowledge. Learners can "know" vocabulary and grammar and still fear speaking. Therefore, programs aiming to improve speaking should not focus only on language content; they must also engineer mastery experiences and reduce threat. This is why interventions emphasizing rehearsal control and audience modulation are so prominent: they are mastery-enablers (Abdullah et al., 2021; Abuhussein et al., 2023).

Exchange-oriented practice as a design principle rather than a single method. The term "exchange-oriented practice" can be interpreted narrowly as student exchange programs, but within the confines of the provided sources, it is best conceptualized as structured communicative exchange: learners speaking with partners (human or mediated), negotiating meaning, and engaging in interaction that is socially real but pedagogically supported. The evidence base points repeatedly to the importance of interaction formats that feel less judgmental and more collaborative, whether through remote tasks, online environments, or classroom-based communicative methods (Abuhussein et al., 2023; Bashori et al., 2022; Akdağ-Çimen & Çeşme, 2022).

In practice, "exchange-oriented" design means the learning task is not a solitary speech delivered under scrutiny. Instead, it is a communicative action embedded in collaboration: co-planning, role-play, peer coaching, design explanation, iterative feedback cycles, and mediated dialogues. This design lowers anxiety because it reduces performance isolation. When speaking is part of joint work, errors are less personal, and communication is judged by usefulness rather than by perfection (Bailey, 2020; Bandura, 1997).

Why STEM-infused contexts can make exchange more meaningful and less threatening. STEM education emphasizes authentic problems, integration across domains, and iterative design. These features can reduce speaking anxiety because they change what speaking is "for." When speaking is framed as explaining a design decision, persuading a team, or reflecting on a prototype, attention shifts to meaning and function. Learners are less likely to interpret minor errors as catastrophic because the goal is to communicate effectively for the task (Bybee, 2010; Charette, 2015).

Furthermore, STEM design culture normalizes iteration. If failure is expected in prototyping, then communicative imperfections can be reframed as normal steps in learning. This is a powerful cultural shift for anxious speakers who interpret errors as proof of incompetence (Bandura, 1997). Preservice teacher STEM experiences that build awareness and pedagogical readiness through collaboration may therefore also build communicative confidence when language speaking is integrated into those collaborative routines (Aslan-Tutak et al., 2017; Berisha & Vula, 2021).

Program design implications for teacher education and

specialized vocabulary learning. Although the prompt asked about "scientific plant names," the provided references support a broader claim: specialized vocabulary and domain talk are best learned when learners can use the terms in meaningful speaking exchanges that are designed to reduce anxiety. In teacher education, this can be operationalized by:

- structuring speaking practice around collaborative projects (STEM design briefs, micro-teaching scripts, explanation tasks) (DiFrancesca et al., 2014; Aslan-Tutak et al., 2017);
- providing rehearsal-friendly formats such as flipped preparation and remote recordings (Abdullah et al., 2021; Abuhussein et al., 2023);
- using motivational framing through gamified challenges and enjoyable speaking routines (Ali, 2022);
- adopting supportive evaluation climates through dynamic assessment principles (Anton, 2009);
- and embedding embodied/role-based speaking to reduce self-consciousness and increase fluency opportunities (Akdağ-Çimen & Çeşme, 2022; Aykac & Cetinkaya, 2013).

These implications align with broader concerns in professional learning and impact research: interventions should be described and designed with conceptual clarity, and their effects should be interpreted relative to their specific features rather than treated as generic "training" (Desimone, 2009).

Limitations. This article is constrained by the reference set provided. Because there are no sources on scientific plant nomenclature or semantic motivation, the synthesis cannot legitimately make botanical naming claims while remaining strictly grounded in citations. Additionally, the intervention studies cited vary in population and context; not all are conducted with preservice teachers, so transfer to preservice settings should be considered a reasoned application of mechanisms rather than a direct population-level generalization (Desimone, 2009). Finally, since effect sizes and uniform outcome measures are not extracted here, the synthesis functions as an evidence-informed design model rather than a statistical meta-analysis (Arthur Jr. et al., 2001; Bangert-Drowns et al., 2004).

Future scope. Future work can proceed in two directions consistent with the literature. First, researchers can conduct a full statistical meta-analysis focused specifically on speaking anxiety interventions, extracting effect sizes across comparable measures and using moderator analysis to test which design features are most influential (Arthur Jr. et al., 2001; Bangert-Drowns et al., 2004). Second, teacher education programs can empirically test integrated models where STEM design tasks are explicitly used as contexts for exchange-oriented speaking practice, measuring impacts on speaking anxiety, self-efficacy, and professional identity development (Aslan-Tutak et al., 2017; Blackmore et al., 2018; Depaepe & König, 2018).

If the goal remains specifically "scientific plant names" and "semantic motivation," future research should also include dedicated linguistic and onomastic references on phytonyms and botanical naming so that claims about semantic motivation and nomenclature learning can be properly supported.

CONCLUSION

Within the boundaries of the provided evidence base, the most defensible conclusion is that effective oral confidence development depends less on a single technique and more on a coherent design logic that produces repeated mastery experiences while reducing social-evaluative threat. Flipped classroom structures, remote speaking tasks, web-based and Web 2.0 speaking practice, gamified mobile learning, dynamic assessment, and embodied communicative methods all contribute to anxiety reduction when they increase controllability, practice frequency, supportive feedback, and meaningful exchange (Abdullah et al., 2021; Abuhussein et al., 2023; Aktaş, 2023; Ali, 2022; Anton, 2009).

Self-efficacy theory explains why these designs matter: confidence grows when learners experience successful performance under manageable conditions and interpret those experiences as evidence of capability (Bandura, 1997). STEM-infused learning environments—especially in preservice teacher education—offer a particularly promising platform for exchange-oriented speaking practice because they require collaboration, iterative explanation, and authentic communication, all of which can normalize imperfection and reduce fear-driven avoidance (Bybee, 2010; Aslan-Tutak et al., 2017; Blackmore et al., 2018).

Accordingly, "learning specialized terminology effectively" (including any future botanical naming focus) should be approached as a design challenge: provide learners with exchange-oriented speaking contexts that are structured for rehearsal, supported by low-threat evaluation climates, and embedded in meaningful collaborative tasks. Under such conditions, anxiety reduction and communicative confidence become predictable outcomes of well-designed learning ecologies rather than accidental byproducts of exposure.

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