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Experiential Learning, Student Engagement and Motivation in Civil Aviation Vocational Education: A Critical Narrative Review

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Abstract

Practice is indispensable in civil aviation vocational education, yet exposure to simulated or workplace activity does not in itself show that students have learned from it. This critical narrative review examines how experiential, work-based, simulation and technology-supported learning relate to student engagement, motivation and learning challenges in vocational and aviation education. A targeted search identified 29 cited sources, which were appraised for methodological transparency, construct alignment and contextual relevance. Across this heterogeneous evidence base, preparation, authentic task design, instructor interaction, feedback, debriefing and opportunities to apply revised understanding recur as conditions that help students interpret experience. The review also shows why engagement should be separated into behavioural, emotional and cognitive dimensions and why motivation cannot be reduced to a simple intrinsic–extrinsic opposition. Reported difficulties—including weak task clarity, uneven guidance, limited resources, technology constraints, teamwork problems and workplace stress—often arise from the learning environment as well as from individual learners. On this basis, the article proposes a non-causal, learner-centred framework linking instructional design, learner responses and enabling conditions to connected cycles of preparation, supported practice, feedback and reflection.

Keywords: Experiential Learning, Student Engagement, Motivation, Vocational Education, Civil Aviation Education

Introduction

Occupational knowledge becomes professionally useful only when students can apply it appropriately in situations that resemble work. This is a demanding requirement in civil aviation education: service standards, safety procedures, communication, teamwork and standardised operations must be understood, but they must also guide action when conditions change. Practice-oriented learning is therefore part of the substance of aviation preparation, not an optional addition to classroom instruction.

Experiential learning provides a useful pedagogical basis for understanding this form of learning. Kolb (1984) conceptualises learning as a process in which concrete experience is transformed through reflective observation, abstract conceptualisation and active experimentation. From this perspective, experience alone does not guarantee learning. Students need opportunities to act, reflect, make sense of what happened and apply revised understanding in subsequent practice. Recent work on work-integrated and experiential learning similarly emphasises intentional curriculum design, authenticity, preparation, guidance, feedback, reflection and post-experience synthesis (Ferns et al., 2025; Radović et al., 2022).

The effectiveness of experiential learning also depends on how students respond to the learning environment. Student engagement provides one lens for examining this response. Fredricks et al. (2004) distinguish behavioural, emotional and cognitive engagement, thereby extending analysis beyond attendance or task completion. In vocational settings, students may perform the same practical task while differing substantially in effort, interest, confidence, reflection and depth of understanding. Research in vocational education indicates that engagement is shaped by school-based and workplace learning experiences, instructional support, collaboration and students' sense of connection with learning (Hong et al., 2021; Niittylahti et al., 2023; Nouwen et al., 2022; Zhao & Ko, 2024).

Motivation is closely connected with these learning experiences. Self-determination theory explains that students may participate for different reasons and with different degrees of self-determination (Ryan & Deci, 2000). In vocational education, students may be motivated by interest in the profession, enjoyment of learning by doing and satisfaction from mastering a task, while also responding to grades, qualifications, teacher requirements, employment opportunities or family expectations. Recent vocational research suggests that motivational patterns interact with instructional support and the learning environment (Held & Mejeh, 2024).

Civil aviation vocational programmes make these theoretical questions concrete because learning is repeatedly organised around simulated and workplace performance. Check-in simulations, passenger-service role play, cabin-service training, security exercises, emergency drills, airport-operation cases and enterprise placements can all bring occupational practice into the curriculum. Their realism, however, is not sufficient evidence of educational value. If the purpose of a task is unclear, feedback is delayed, practice time is restricted or team roles are uneven, students may complete the activity without understanding what should transfer to later work. Accounts of workplace learning and simulation debriefing also identify inconsistent guidance, weak preparation and stress as conditions that alter what learners can gain from an experience (Pylväs et al., 2022; Sellberg & Giskeødegård, 2025).

The evidence available to civil aviation educators is divided across two partly separate conversations. Aviation studies commonly evaluate a particular technology, course or training arrangement, while vocational research more often examines engagement, motivation and workplace learning across diverse programmes. Neither body of work, on its own, fully explains how aviation students respond to different forms of practice-oriented learning. Reading them together makes it possible to identify transferable design principles while keeping the limits of context and measurement visible.

Accordingly, this review aims to synthesise literature on experiential learning, student engagement, motivation and learning challenges in vocational and practice-oriented education, with particular attention to implications for civil aviation vocational education. The review addresses three guiding questions: (1) What pedagogical conditions support meaningful experiential learning in vocational contexts? (2) How are student engagement and motivation described within experiential, work-based and simulation-oriented learning? and (3) What challenges and support conditions should civil aviation vocational educators consider when designing practice-oriented learning activities?

The review contributes in three ways. First, it integrates experiential-learning design with three learner-response lenses—engagement, motivation and experienced challenges—rather than examining a single technology or training format. Second, it distinguishes direct measures of engagement and motivation from adjacent constructs such as learning immersion, satisfaction, self-efficacy, professional identity and behavioural intention. Third, it develops a non-causal layered synthesis linking instructional design and support, learner responses, enabling or constraining conditions, and curriculum implications for civil aviation vocational education.

Review Approach

This article adopts a critical narrative review supported by a transparent targeted search. It is not presented as a systematic review and does not claim exhaustive coverage. The search was conducted on 31 August 2026 using focused searches of ERIC and Korean Citation Index (KCI) records where relevant, supplemented by publisher, journal and other authoritative bibliographic pages. These sources were used to identify and verify studies in vocational education, experiential and work-based learning, aviation-service education, simulation, virtual reality, field learning and internship experience. Peer-reviewed sources identified during earlier scoping work were re-screened for relevance to the present review, and backward citation checking was used to retain foundational and recent sources.

Search terms and combinations included: “experiential learning” AND “vocational education”; “work-based learning” AND “student engagement”; “aviation education” with simulation, virtual reality, internship or field learning; “aviation service” with engagement, learning immersion, motivation or self-efficacy; and “civil aviation vocational education” AND China. Priority was given to peer-reviewed empirical or review studies published from 2021 to August 2026. Earlier works were retained when they provided foundational theory or directly relevant vocational-simulation evidence. Studies were included when they addressed at least one of the following: experiential, work-based, field or simulation learning in vocational or aviation education; behavioural, emotional or cognitive engagement; intrinsic or extrinsic motivation; instructor support, feedback or reflection; or learner-experienced challenges relevant to practice-oriented education. Studies focused only on technical aviation performance without an educational or learner-response component were not prioritised.

Candidate studies were screened by title and abstract for relevance to the review questions, after which source details and key findings were checked against journal, publisher or other authoritative bibliographic pages where available. The final synthesis drew on 29 cited sources, comprising foundational theoretical works and recent empirical, review, design and contextual studies. The literature was then organised into five synthesis areas: (1) experiential

learning as curriculum and pedagogy, (2) student engagement, (3) motivation, (4) pedagogical challenges and support conditions, and (5) implications for civil aviation vocational education. The synthesis is interpretive rather than meta-analytic because the reviewed studies use heterogeneous contexts, constructs and methods.

Critical Appraisal and Evidential Scope

Because the review is narrative rather than meta-analytic, the included studies were not statistically pooled and no formal risk-of-bias score was assigned. Interpretation instead considered each source's methodological transparency, construct alignment and contextual relevance to the review questions. Greater weight was given to studies with clearly described samples, constructs and methods and to evidence directly examining vocational, work-based or aviation-learning contexts. Cross-sectional self-report studies, single-site programme evaluations, technology-adoption studies and conceptual papers were interpreted more cautiously because they cannot independently establish causal effects or support broad generalisation across civil aviation vocational settings.

The reviewed sources also differ in how closely their constructs match the focus of this paper. Studies that directly examine behavioural, emotional or cognitive engagement are more relevant to the engagement synthesis than studies of learning immersion, satisfaction or behavioural intention, although these adjacent constructs can still provide contextual evidence about intensive involvement in learning. Likewise, studies of technology acceptance or professional identity can inform the motivation discussion without being treated as direct measures of intrinsic and extrinsic motivation. Evidence from aviation-service majors, pilots, aircraft-maintenance students and other professional fields was therefore compared for transferable pedagogical patterns rather than treated as if all groups represented the same learner population.

A further distinction was made between theoretical, empirical and contextual evidence. Foundational sources were used to define experiential learning, engagement and motivation; vocational and work-based studies were used to identify recurring learner and pedagogical patterns; and aviation-specific or China-specific studies were used to assess contextual relevance. This layered approach reduces overgeneralisation while allowing a necessarily heterogeneous literature base to be integrated coherently.

Table 1 identifies the evidential function assigned to each group of sources and records the main caution used when transferring its findings to civil aviation vocational education.

Table 1
Review evidence map for the 29 cited sources

Evidence group	**Representative sources**	**Main contribution**	**Interpretive role / caution**
Foundational theory	Kolb (1984); Fredricks et al. (2004); Ryan & Deci (2000)	Experiential cycle; engagement dimensions; motivational regulation	Conceptual foundation, not outcome evidence
Experiential / WIL design	Ferns et al. (2025); Radović et al. (2022); Molendijk et al. (2025)	Preparation, authenticity, reflection, collaboration, facilitation	Empirical/design evidence for sequencing and support
Vocational engagement	Hong et al. (2021); Niittylahti et al. (2023); Nouwen et al. (2022); Zhao & Ko (2024); Surtiningtyas et al. (2025)	Behavioural, emotional, cognitive and agentic engagement; instructional structure	Strongest construct alignment for engagement synthesis
Challenges / support	Pylväs et al. (2022); Sellberg & Giskeødegård (2025); Shahanaz & Masthan (2025)	Workplace support, stress, debriefing, faculty–student gaps	Direct learner-experience evidence; context transfer requires caution
Aviation-service learning	Cho & Kim (2024); Kim (2023, 2024); Kim & You (2023)	Immersion, self-efficacy, satisfaction, role play, field learning	Adjacent outcomes; mostly programme- or context-specific
Technology-mediated learning	Nguyen et al. (2024); Toring et al. (2025); Dela Peña (2025); Rizvi et al. (2025); Rafiq et al. (2022); Demirdöken & Atay (2024)	VR, simulation, gamification, adoption and immersion	Technology outcomes should not be equated with engagement
Motivation / internship	Held & Mejeh (2024); Wang (2025); Seo (2024)	Motivational trajectories, professional identity, internship quality, instructor support	Motivation-focused evidence; constructs and contexts vary
China civil aviation context	Li (2024); Zhang (2023)	Industry–education integration; virtual simulation	Institutional context; transfer should be localised

Note. WIL = work-integrated learning; VR = virtual reality.

Experiential Learning as Curriculum and Pedagogy in Vocational Education

Practical exposure is not equivalent to learning. Experiential learning becomes educationally meaningful when experience is connected with preparation, reflection, conceptual understanding, feedback and opportunities for subsequent application. Kolb's experiential learning theory provides the classic account of this process through concrete experience, reflective observation, abstract conceptualisation and active experimentation. In vocational education, this sequence is particularly relevant because students must connect occupational action with the reasons, standards and concepts that guide professional performance.

Recent scholarship treats experiential learning as a curriculum problem rather than a question of how many practical activities a programme offers. Ferns et al. (2025) organise quality work-integrated learning around preparation before the experience, authentic participation during it and synthesis afterward. Radović et al. (2022) approach the issue from the design of learning environments and give particular weight to authenticity, reflection and collaboration. The emphases differ, but both accounts locate educational value in the connections made before, during and after practice. A realistic task that is poorly sequenced or weakly interpreted may therefore remain an event rather than become a learning process.

Debriefing illustrates why the sequence around an activity matters. In the simulation literature reviewed by Sellberg and Giskeødegård (2025), participants generally valued group reflection, yet the learning produced by a debrief depended on facilitation, the specificity of feedback, attention to learning objectives and the way the event was reconstructed. Molendijk et al. (2025) reached a related conclusion from a comparison of experiential activities outside aviation: engagement varied with authenticity and relevance, but also with the level of detail, the learning cycle and facilitation. The two studies address different settings and outcomes, so they do not establish a common effect size. They do, however, challenge the assumption that performance is self-explanatory. Learners need help to connect what they did, why it mattered and what they would change in a subsequent attempt.

For civil aviation vocational education, the design problem is not a choice between realism and structure; realistic practice requires structure if students are to learn from it. A check-in simulation or emergency drill, for example, can reproduce visible procedures while leaving their service or safety rationale implicit. The activity should therefore begin with a clear purpose and criteria, continue with observed performance and defined team roles, and end with feedback, debriefing and an opportunity to try again. Not every exercise needs to be elaborate. What matters is whether it occupies a clear place in a sequence through which students can revise both their performance and the reasoning behind it.

Student Engagement in Experiential and Vocational Learning

Task completion is a poor proxy for engagement. Fredricks et al. (2004) separate behavioural engagement from students' emotional responses and cognitive investment, which makes the distinction particularly useful in practice-based education. Two learners may carry out the same aviation procedure correctly, yet one may be persisting only to satisfy a requirement while the other is questioning the rationale, using feedback and relating the task to future work. Analysing these dimensions separately prevents visible compliance from being mistaken for equally meaningful involvement.

Vocational research shows that engagement is strongly situated in the learning environment. Nouwen et al. (2022) examine work-based learning as a context for student engagement in vocational education, while Hong et al. (2021) show that behavioural engagement can be studied across both school and firm-internship settings. Niittylahti et al. (2023) further demonstrate that vocational students can develop different engagement profiles over time, influenced by interest, connectedness and learning experiences. Zhao and Ko (2024) identify adaptive structure, collaboration and real-life connections as instructional features associated with engagement in vocational classrooms. More directly in aviation vocational higher education, Surtiningtyas et al. (2025) reported cross-sectional associations among situational motivation, personal-best goals and behavioural, emotional, cognitive and agentic engagement in 267 Indonesian students. Taken together, these findings suggest that engagement is not a fixed learner trait; it can be supported or weakened by the way practical learning is organised.

Aviation-specific studies provide increasingly relevant evidence. Cho and Kim (2024) examined aviation-service students and found that academic interaction with instructors was positively associated with cognitive, emotional and behavioural learning immersion, a related but distinct construct from engagement, underscoring the role of instructional interaction in practice-oriented aviation majors. Kim and You (2023) examined aviation-service students' perceptions of field-learning programmes, focusing on learning satisfaction, academic self-efficacy and intention to continue learning. Kim (2023) also reported learning effects associated with role-play-based instruction in aviation-service subjects, highlighting the relevance of participatory teaching methods for an occupation in which service encounters and communication must be practised rather than only described.

Technology-mediated aviation training provides another perspective. Nguyen et al. (2024) reported that integrating virtual reality into aviation-oriented higher education was perceived by students as valuable for engagement and interest. Related vocational-education research likewise suggests that virtual reality can support learner engagement when it brings realistic practice into the learning environment (Rafiq et al., 2022). Toring et al. (2025) studied 241 aviation-technology students using flight simulators and found that motivational and technology-adoption factors were associated with behavioural intention and immersion. In aircraft-maintenance education, Dela Peña (2025) reported increased engagement and motivation after gamified digital learning, while also noting practical constraints such as connectivity and time. These studies are not identical in design or outcome measurement, but together they suggest that task authenticity, instructional support, technology usability and perceived professional relevance are relevant considerations when interpreting engagement-related outcomes in aviation education.

In civil aviation vocational education, these findings support considering behavioural, emotional and cognitive engagement separately. A student who follows every operational step may still feel disconnected from the activity, while an enthusiastic student may participate actively without reflecting on the rationale behind procedures. Curriculum and teaching should therefore create opportunities for action, emotional investment and deeper thinking rather than assuming that attendance or completion alone represents successful experiential learning.

At the same time, the strength of the engagement evidence is uneven. The vocational studies provide stronger construct alignment because they explicitly examine engagement, whereas several aviation studies use related outcomes such as learning immersion, satisfaction, intention to continue learning or technology-use intention. These outcomes are informative but should not be treated as interchangeable with behavioural, emotional and cognitive engagement. In addition, much of the aviation-specific evidence is cross-sectional or programme-specific, which limits claims about direction of influence. The most defensible conclusion is therefore that instructional interaction, authentic practice and supportive learning conditions are repeatedly associated with engagement-related outcomes, while direct aviation-specific evidence using multidimensional engagement measures remains limited.

Motivation in Vocational and Practice-Oriented Learning

Motivation helps explain why students choose to participate, persist and invest effort in experiential learning. Self-determination theory distinguishes intrinsic motivation, in which activity is pursued for inherent interest or satisfaction, from extrinsic reasons linked to separable outcomes or expectations (Ryan & Deci, 2000). In vocational education, the distinction is especially useful because learning is simultaneously educational and career-oriented. Students may enjoy mastering an occupational task while also being motivated by grades, professional certification, internship opportunities or future employment.

Held and Mejeh (2024) locate changes in vocational students' motivation within the instructional environment rather than treating motivation as a stable quality that learners simply bring to class. Read alongside self-determination theory, their work shifts attention to whether a task permits some autonomy, makes progress visible and has an intelligible purpose (Ryan & Deci, 2000). In experiential learning, these conditions are not guaranteed by practical activity itself. A demanding task may be motivating when students see it as achievable and professionally consequential, whereas repeated performance without explanation or usable feedback may weaken its value even when the setting appears authentic.

Evidence from three technology-supported formats shows why motivational findings need to be interpreted at the level of the activity. Toring et al. (2025) examined flight-simulator use through a hedonic-motivation and technology-acceptance framework; their outcomes concerned intention and immersion rather than intrinsic motivation alone. Nguyen et al. (2024) reported favourable student responses to virtual reality in an aviation curriculum, while Dela Peña (2025) found increases in reported motivation, engagement and knowledge retention after gamification in aircraft-maintenance education. These studies do not demonstrate that technology is inherently motivating. They indicate that students' responses depend on how the tool is experienced and on how its design is connected to the technical work being learned.

In aviation-service education, motivation is also tied to the professional future that an activity represents. Field learning and role-play rehearse service encounters and workplace responsibilities rather than merely presenting occupational information (Kim, 2023; Kim & You, 2023). Enjoyment of performing the role or satisfaction in mastering a behaviour may coexist with concern for assessment, certification and employability. Treating the first set of

reasons as authentic and the second as inferior would misrepresent vocational learning. External goals can be personally meaningful when students understand how a qualification or standard relates to the work they hope to enter.

Curriculum design should therefore connect professional relevance with a credible experience of learning progress. Students need to know what an activity prepares them to do, how the expected standard is judged and what improvement looks like after feedback. Grades and compulsory participation can secure attendance, but they offer little evidence that students value the task or feel capable of improving. The more defensible aim is not to remove external requirements, but to place them within activities that also support competence, purpose and informed choice.

The available studies do not support classifying every aviation learner as either intrinsically or extrinsically motivated. Self-determination theory describes differences in the quality of regulation along a continuum, and the aviation studies reviewed here measure several other constructs, including general learning motivation, professional identity, technology acceptance and hedonic motivation (Ryan & Deci, 2000). These findings help explain how relevance, competence, identity and learning conditions enter students' reasons for participation, but they are not equivalent measures. This review therefore uses intrinsic and extrinsic motivation as analytic reference points, not as an exhaustive typology or a binary test applied to students.

Pedagogical Challenges and Support Conditions

Learner difficulty in experiential education cannot be located automatically within the individual. Pylväs et al. (2022) found that vocational students valued the authenticity of workplace learning, but some also reported stress, inadequate workplace introduction, inconsistent guidance and limited opportunities to set goals or reflect. Authenticity and support were therefore not interchangeable: the setting could be real while the learning process remained uneven. For interpretation, this means that hesitation, weak performance or withdrawal may reflect the interaction of prior preparation with task design, relationships, resources and workplace organisation rather than a simple lack of ability or motivation.

Some difficulties are built into the architecture of the activity. Ferns et al. (2025) emphasise preparation and post-experience synthesis, whereas Radović et al. (2022) draw attention to authenticity, reflection and collaboration. Considered together, these studies expose a predictable problem: students can follow instructions successfully while remaining unclear about the objective, the professional rationale or the connection with prior knowledge. Sellberg and Giskeødegård's (2025) analysis of debriefing adds a further qualification. Reflection is not secured simply by scheduling a discussion; its value varies with facilitation, feedback and attention to the learning objectives of the simulated event.

A separate set of problems concerns the interaction through which practice is supported. Zhao and Ko (2024) show the value of adaptive and structured instruction and collaborative learning in vocational classrooms. In aviation-service education, Cho and Kim (2024) found that academic interaction with instructors was associated with learning immersion. These findings suggest that students need timely explanation, modelling, feedback and opportunities to ask questions, particularly when they are learning safety-sensitive or

standardised procedures. A lack of support may be experienced as a personal confidence problem even when the underlying issue is insufficient scaffolding.

Resource and technology constraints can also affect experiential learning. Dela Peña (2025) identified connectivity and time constraints in gamified aircraft-maintenance learning. Rizvi et al. (2025), examining general-aviation pilot training, found strong interest in flight-simulation training devices and augmented reality, while also noting that these technologies remain underused in the training context they studied. At the institutional level in China, Li (2024) surveyed 52 civil aviation colleges and 15 civil aviation enterprises and identified problems in industry-education integration, including misalignment between educational supply and industry demand and unstable cooperation mechanisms. Such constraints determine not only whether an activity is available, but also whether different groups of students receive a comparable opportunity to learn from it.

Not every participation problem begins with curriculum structure or technology. Team roles can be poorly distributed, communication can break down, and students enter an activity with different levels of confidence, preparation and familiarity with aviation settings. Shahanaz and Masthan (2025) also report a perceptual gap across institutions: behaviour read by faculty as disinterest was described by students in terms of motivational barriers and unmet support needs. The contrast is important because the same hesitation can lead to different pedagogical decisions depending on whether it is labelled as unwillingness, uncertainty or inadequate preparation.

In civil aviation vocational education, challenges can therefore be treated as diagnostic information about the learning environment. Difficulties involving task clarity, equipment, practice time, teamwork, feedback, confidence or workplace arrangements should be used to identify where curriculum sequencing and instructional support can be strengthened. This perspective avoids placing the responsibility for successful experiential learning entirely on students.

The evidence on challenges is strongest where studies provide direct accounts of students' workplace or practice-based experiences, as in qualitative or mixed-method vocational research. Technology studies contribute a different type of evidence because they often identify usability, access or adoption constraints rather than the full range of pedagogical challenges. Evidence from nursing, nautical education, pilot training or university-level aviation programmes is also transferable only at the level of broad pedagogical principles such as debriefing, feedback, authenticity and support. These contextual differences mean that challenge categories should be treated as sensitising themes for civil aviation vocational education, not as a fixed list that is assumed to apply equally across institutions.

Implications for Civil Aviation Vocational Education

Civil aviation vocational education is a particularly strong setting for experiential learning because many core competences are difficult to develop fully through lecture alone. Service communication, airport operations, cabin procedures, security inspection, maintenance, emergency response and teamwork require students to practise actions in contexts that resemble professional situations. The reviewed evidence suggests, however, that effective

experiential learning requires deliberate pedagogical design rather than simply increasing the amount of practical activity.

Evidence from aviation-service education supports the value of authentic and participatory learning. Kim and You (2023) examined students' perceptions of field-learning programmes in an aviation-service major, while Kim (2023) studied role-play instruction designed to strengthen learning in aviation-service subjects. Cho and Kim (2024) show that instructor-student academic interaction is associated with cognitive, emotional and behavioural immersion among aviation-service students. Together, these studies suggest that professional practice, interpersonal interaction and instructor support are closely connected in aviation-service education.

Technology-supported studies broaden the range of aviation activities considered, but they also illustrate the heterogeneity of the evidence. Demirdöken and Atay (2024) use simulation in aviation English learning for aspiring pilots, whereas Nguyen et al. (2024) report student responses to virtual reality in aircraft operational-maintenance training. Toring et al. (2025) analyse immersion and intended simulator use through motivational and technology-acceptance factors. Rizvi et al. (2025) identify interest in simulation and augmented reality among general-aviation pilots alongside regulatory and financial barriers, and Dela Peña (2025) reports benefits and practical constraints in gamified aircraft-maintenance learning. Because the populations and outcomes differ, these studies cannot establish a single technology effect. Their shared implication is narrower: a tool becomes educationally relevant when access, usability and instructional purpose allow it to support credible professional practice.

Evidence from China shows that activity design is constrained by institutional arrangements. Zhang (2023) considers virtual simulation in civil aviation vocational colleges, while Li (2024) uses evidence from colleges and enterprises to identify continuing weaknesses in industry–education integration. The studies address different parts of the system, but both place classroom practice within conditions that individual teachers cannot fully control. Access to workplaces, current equipment, industry-standard procedures and sustained enterprise participation affect whether an activity is both occupationally credible and educationally coherent. These conditions should therefore be examined when localising pedagogical recommendations, rather than assumed to be uniform across colleges.

Eight curriculum implications emerge from the reviewed literature. First, experiential activities should be embedded in an intentional sequence rather than treated as isolated practice sessions. Second, preparation and clear task purposes should precede simulation or workplace activity. Third, structured debriefing and reflection should follow practice. Fourth, feedback should connect procedural performance with professional reasoning. Fifth, collaboration and role allocation should be deliberately organised. Sixth, behavioural, emotional and cognitive engagement should be considered separately rather than inferred from attendance. Seventh, motivation should be supported through both meaningful professional relevance and appropriate external structures such as qualifications and career pathways. Eighth, barriers involving resources, confidence, guidance, technology and workplace conditions should be treated as curriculum and support issues rather than attributed only to the learner.

Civil aviation vocational colleges also need stronger learner-centred evidence. Within the literature reviewed here, many aviation-education studies evaluate technologies, programmes or teaching arrangements, whereas comparatively fewer examine how students simultaneously experience engagement, motivation and challenges across multiple forms of experiential learning. Future research should therefore combine evidence about curriculum design with students' own accounts of participation, interest, reflection and support needs. This would help institutions identify not merely whether experiential activities are available, but whether students are actually learning from them.

The implications should also be read according to the type of evidence that supports them. The strongest theoretical claims come from established frameworks of experiential learning, engagement and motivation. Broader vocational and work-based studies provide the main empirical support for recurring patterns involving guidance, reflection, collaboration and learner response. Aviation-specific studies strengthen contextual relevance but are more heterogeneous in population, design and outcome measurement. For this reason, the review does not claim that a single pedagogical model has been causally validated across civil aviation vocational education; rather, it identifies a set of recurring design principles that warrant local testing and adaptation.

Integrated Conceptual Synthesis

Figure 1 summarises the proposed layered synthesis as an organising framework rather than a validated causal model. The figure makes the analytical relationships among the four layers explicit while preserving the distinction between theoretically informed associations and established causal effects.

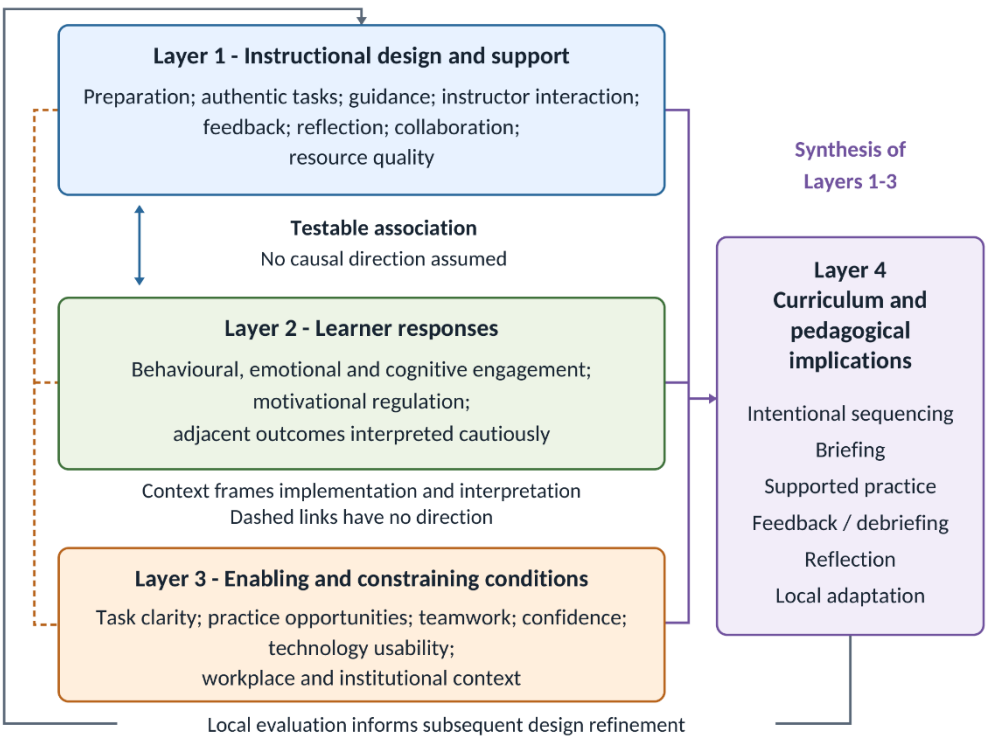

Figure 1 Non-causal layered synthesis for civil aviation vocational education

Note. Dashed lines connect contextual conditions to instructional design and learner responses. Solid arrows indicate synthesis and local-evaluation feedback; the double-headed arrow marks an association to test. No connector denotes an established causal effect.

Figure 1 arranges the literature into layers so that different kinds of claim are not confused, while also showing how the layers can inform one another. Layer 1 concerns what educators design and provide, whereas Layer 2 concerns learner responses. These two layers are linked as a testable, non-causal association: instructional design and support can be examined alongside behavioural, emotional and cognitive engagement and motivational regulation without assuming a predetermined direction of effect. Layer 3 identifies conditions that may shape how instructional arrangements are implemented and how learner responses are interpreted, including task clarity, practice opportunities, teamwork, confidence, technology usability and workplace context. Layer 4 translates evidence from the preceding layers into curriculum and pedagogical decisions, while local evaluation can in turn refine subsequent instructional design. The connectors therefore represent analytical relationships and feedback for inquiry rather than established causal pathways.

The evidence does not justify drawing causal arrows between these layers. Cross-sectional surveys, qualitative accounts, programme evaluations, design studies and conceptual papers answer different questions. Within those limits, three patterns recur. Instructor interaction is associated with immersion, self-efficacy or motivation in aviation-service samples (Cho & Kim, 2024; Seo, 2024). Work- and field-based studies report relationships among engagement, satisfaction, academic self-efficacy and persistence (Kim, 2024; Kim & You, 2023; Nouwen et al., 2022). Wang's (2025) cross-sectional mediation analysis in China further links internship quality with motivation indirectly through professional identity. These results are compatible with the proposed framework, but they do not validate it. They indicate where relationships are sufficiently recurrent to warrant direct testing in civil aviation vocational colleges.

The framework can be tested empirically by operationalising each layer separately and examining their relationships across multiple experiential activities. Layer 1 can be represented through observed or reported features such as preparation, authenticity, guidance, instructor interaction, feedback and reflection; Layer 2 through multidimensional engagement measures, motivational regulation and carefully distinguished adjacent outcomes; Layer 3 through contextual indicators such as task clarity, practice opportunities, teamwork, confidence, technology usability and workplace conditions; and Layer 4 through documented curriculum decisions and subsequent local evaluation of whether sequencing, support, feedback and reflection are revised in response to evidence from the preceding layers. Repeated-measures or longitudinal mixed-method studies could then examine whether associations between instructional design and learner responses remain consistent across activities and whether contextual conditions alter their strength or interpretation. Where students are nested within classes, programmes or institutions, multilevel analysis could further separate learner-level variation from differences in instructional or organisational context. Qualitative follow-up could be used to explain how students interpret the same design features differently. These approaches would test the proposed relationships without assuming causality in advance.

The framework deliberately keeps engagement and motivation separate. Engagement concerns what participation looks and feels like while learning is taking place; motivation concerns the reasons that initiate or sustain that participation. Their relationship can vary. A student may comply closely with an operational procedure because assessment requires it, while another may value the occupation but lack the confidence or scaffolding needed to participate effectively. Curriculum evaluation should therefore examine both the quality of students' involvement and the reasons attached to it, instead of using one construct as a substitute for the other.

A further implication concerns where a learning problem is located. Low participation or weak motivation may be visible in the student, but the reviewed evidence repeatedly places its possible sources across task design, instructor support, peer organisation, technology, institutional resources and workplace arrangements. A learner-centred response therefore begins with diagnosis rather than attribution. Educators need to ask which part of the activity or environment is obstructing participation before concluding that the learner lacks commitment or capacity.

Limitations of the Review

This review has several limitations. The principal limitation is the limited amount of evidence derived directly from civil aviation vocational colleges. The aviation-specific evidence reviewed here comes mainly from aviation-service majors, pilot and aircraft-maintenance training, simulation-oriented programmes and a small number of China-specific civil aviation studies. Broader claims about engagement, work-based learning, debriefing, collaboration and learner support therefore also draw on wider vocational and professional fields. These transferred sources are used to identify potentially relevant pedagogical principles, not as direct evidence that the same relationships or effects occur in civil aviation vocational colleges. The framework should consequently be tested and adapted locally rather than treated as a universal model of aviation vocational learning.

Second, as a critical narrative review, the targeted search was designed to identify relevant and recent literature rather than to provide exhaustive coverage of every database or publication. Relevant studies may therefore have been missed, particularly work published in databases, languages or institutional repositories not reached through the search process used here.

Third, the evidence base is heterogeneous. The reviewed studies include cross-sectional surveys, qualitative studies, programme evaluations, design-based research, conceptual papers and technology-adoption studies. Their constructs also vary, with some studies measuring engagement directly and others examining adjacent outcomes such as learning immersion, satisfaction, self-efficacy, persistence, professional identity or behavioural intention. These differences limit direct comparison and prevent strong causal or effect-size conclusions.

Finally, the review did not apply a formal risk-of-bias instrument because it was designed as a critical narrative synthesis rather than a systematic effectiveness review. Judgements about evidential strength were made through study design, construct alignment, contextual relevance and limitations reported by the original authors. This approach supports cautious

interpretation but is less reproducible than a formal appraisal procedure. A subsequent systematic review could test the patterns identified here through predefined database coverage, duplicate screening, explicit quality criteria and transparent study-selection counts.

Conclusion

Taken together, the literature supports a narrower claim than "practice improves learning." In civil aviation vocational education, practice becomes educational when the curriculum gives students a reason for the task, support while performing it and a structured opportunity to interpret the result. Preparation, authenticity, instructor interaction, feedback, reflection and further application recur across otherwise heterogeneous studies. Their importance lies in how they connect an activity to professional reasoning. This helps explain why students can complete the same practical exercise while differing in persistence, emotional investment and depth of thought.

The motivation evidence adds a second qualification: participation has more than one legitimate basis in vocational education. Interest, mastery and identification with aviation work coexist with assessment, certification and employment goals. Wang (2025) reports an indirect association between internship quality and motivation through professional identity in a Chinese aviation-service sample, while Cho and Kim (2024) and Seo (2024) associate instructor interaction or support with immersion and learning motivation. Because these studies are cross-sectional or context-specific, they do not demonstrate a common mechanism. They nevertheless direct attention to professional identity, competence and visible progress as testable features of curriculum design.

The principal evidential limitation is the small amount of direct research from civil aviation vocational colleges. The aviation-specific studies reviewed here support narrower conclusions about instructor interaction, field learning, simulation and technology-supported practice, professional identity and institutional constraints. By contrast, several broader patterns concerning multidimensional engagement, structured debriefing, collaboration, work-based learning and learner support are informed partly by evidence transferred from wider vocational and professional fields. Those patterns are therefore best treated as context-sensitive propositions for local testing rather than as established aviation-specific effects. Research in civil aviation vocational colleges should combine learner-level measures and accounts with analysis of the curriculum that produced them. For current practice, the most defensible implication is to connect activities rather than accumulate them: make the purpose and criteria explicit before performance, organise participation and support during it, and use feedback and reflection to relate procedures to professional judgement afterward.

The principal conclusion therefore concerns design, not volume. Adding simulations, placements or practical hours cannot by itself show that learning has improved. Civil aviation preparation must develop accurate performance, but it must also help students explain the standards behind that performance, respond to feedback and sustain a professionally meaningful reason to improve. The proposed framework makes the relationships among instructional design, learner responses, contextual conditions and curriculum implications explicit and identifies them as propositions that can be examined empirically without claiming causal effects that the present evidence cannot establish.

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