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Improving the Methodology for Developing Independent Learning Activities in Students in a Digital Learning Environment

Esanmurodov Otamurod Boboqand O'g'li[1], Aliboyev Sobir[2], Dr. Parthasarathi Murugesan[3]*

[1, 2] Assistant Professor, Jizzakh Branch, National University of Uzbekistan, Uzbekistan
[3] Associate Professor, Department of Information Technology and Artificial Intelligence, Jizzakh State Pedagogical University, Uzbekistan.
*Corresponding Author Email: parthasarathi.murugesan@gmail.com | ORCID: 0009-0007-5219-7940

ABSTRACT: Independent learning — the capacity of a student to set goals, select strategies, monitor progress, and evaluate outcomes with diminishing external direction — is widely recognised as a core determinant of lifelong learning readiness, yet it remains one of the most inconsistently and informally developed competencies in formal education. The rapid expansion of digital learning environments (learning management systems, adaptive e-learning platforms, e-portfolios, and learning-analytics dashboards) has created new infrastructural capacity for supporting independent learning, but institutional practice has generally lagged behind this capacity: digital tools are frequently deployed to deliver content rather than to scaffold the self-regulatory processes that independent learning requires. This paper proposes an improved methodology — the Independent Learning Activity Development (ILAD) model — for the systematic, digitally-supported development of independent learning activities among students, grounded in self-regulated learning (SRL) theory and self-determination theory (SDT). The methodology is structured as a five-phase design (Diagnose, Structure, Equip, Enact, Reflect) that progressively transfers regulatory responsibility from instructor to learner across a scaffolded autonomy-support cycle, using digital tools as both delivery and diagnostic infrastructure. The paper presents a conceptual framework, an independent-learning competence matrix, a phase-wise implementation protocol, a digital-environment integration architecture, an assessment and evaluation framework built on self-regulation indicators, and a validation strategy for future empirical piloting. The methodology is intended to guide curriculum designers, instructors, and institutional quality-assurance bodies in redesigning digital learning environments so that they actively cultivate — rather than passively host — independent learning behavior. Implications for practice, anticipated outcome indicators, limitations, and directions for future empirical validation are discussed.

1. INTRODUCTION

Independent learning is variously defined in the educational literature as self-directed learning, autonomous learning, or self-regulated learning, but converges on a common core: the learner's capacity to initiate, plan, execute, monitor, and evaluate their own learning process with progressively less reliance on direct instructor control. Independent learning is consistently linked in the literature to durable academic achievement, adaptability in changing occupational and informational environments, and readiness for lifelong learning beyond formal education. Its development has therefore long been an explicit, if unevenly pursued, objective of higher and vocational education systems.

The widespread adoption of digital learning environments — learning management systems (LMS), adaptive e-learning platforms, massive open online course (MOOC) infrastructure, e-portfolios, and learning-analytics dashboards — has fundamentally altered the conditions under which independent learning could, in principle, be developed. Digital environments make available continuously accessible content, self-paced progression, automated formative feedback, and fine-grained behavioral data on learner activity that were not previously available at scale. In practice, however, a substantial body of literature and institutional experience suggests that digital learning environments are frequently used primarily as content-delivery and administrative infrastructure, replicating rather than transforming the instructor-directed model of learning, and that the mere presence of digital tools does not automatically produce independent learning behaviour — and may, where learners lack adequate self-regulatory skill, produce disengagement, procrastination, or superficial task completion instead.

This paper addresses that gap by proposing an improved methodology for developing independent learning activities in students specifically within digital learning environments, in which digital tools are deliberately structured to scaffold the cognitive-strategic and metacognitive-regulatory processes that independent learning requires, rather than being deployed as passive content repositories. The methodology draws on self-regulated learning (SRL) theory (particularly Zimmerman's cyclical phase model), self-determination theory (SDT) and its account of autonomy-supportive instruction, and instructional-design principles for scaffolded autonomy transfer, to propose a structured, replicable, and digitally-implementable model.

1.1 Significance of the Study

The significance of this methodology is threefold. First, for institutions increasingly reliant on digital and blended delivery, it offers a structured mechanism for ensuring that digital learning environments are pedagogically designed to build learner autonomy rather than incidentally hosting it. Second, for curriculum designers and instructors, it provides a phase-wise blueprint for the deliberate, gradual transfer of regulatory responsibility from instructor to learner, addressing a commonly reported failure mode in which learners are given digital independence prematurely, without adequate scaffolding. Third, for the broader educational-technology literature, it contributes an integrative bridge between self-regulated learning theory and digital-environment design practice, two bodies of scholarship that are frequently cited together but less frequently operationalized into a single implementable methodology.

1.2 Structure of the Paper

The remainder of the paper is organized as follows. Section 2 reviews the relevant literature on independent and self-regulated learning theory, digital learning environments, and prior attempts at digitally scaffolding learner autonomy. Section 3 identifies the research gap and states the study's objectives. Section 4 presents the proposed methodology, including the conceptual framework, the competence matrix, and the five-phase design protocol. Section 5 elaborates the digital-environment integration architecture. Section 6 describes the instructional implementation design. Section 7 presents the assessment and evaluation framework. Section 8 outlines a validation strategy for future empirical piloting. Section 9 discusses expected outcomes and implications. Section 10 notes limitations, and Section 11 concludes with directions for future research.

2. LITERATURE REVIEW

2.1 Self-Regulated and Independent Learning Theory

Zimmerman's cyclical phase model conceptualizes self-regulated learning (SRL) as a recursive three-phase process comprising forethought (goal-setting, strategic planning, and self-efficacy activation), performance (self-control and self-observation during task execution), and self-reflection (self-judgment and self-reaction that feed forward into the next forethought phase). This model has become the dominant theoretical reference point for independent-learning research, providing a process-level vocabulary — rather than a single trait description — for what "independence" in learning actually consists of at each stage of a task.

Complementing SRL theory, self-determination theory (SDT) explains the motivational conditions under which learners are willing to exercise self-regulation: SDT proposes that autonomy-supportive (as opposed to controlling) instructional environments, which satisfy learners' needs for autonomy, competence, and relatedness, are associated with more internalised, sustained engagement in self-directed activity. Together, SRL and SDT provide the theoretical foundation for the methodology proposed in this paper — SRL specifying the process architecture of independent learning, and SDT specifying the motivational conditions under which learners will engage with that architecture rather than disengage from it.

2.2 Digital Learning Environments and Learner Autonomy

A substantial literature examines the relationship between digital learning environments and learner autonomy, generally converging on the finding that digital tools possess considerable theoretical capacity to support self-regulation — through self-paced progression, automated formative feedback, and visible progress tracking — but that this capacity is frequently under-realised in practice. Studies of LMS usage patterns commonly report that digital environments are used predominantly for content posting, assignment submission, and administrative communication, with self-regulatory scaffolding features (goal-setting prompts, planning tools, reflective components) either absent, underused, or bolted on without integration into the core learning task design.

2.3 Digital Scaffolds for Self-Regulation

A more specific stream of research examines particular digital mechanisms for supporting self-regulation: adaptive learning systems that adjust task difficulty or sequencing based on learner performance; digital self-assessment and low-stakes quiz tools that support the self-observation and self-judgment sub-processes of SRL; e-portfolios and reflective-journaling platforms that operationalise the self-reflection phase of Zimmerman's model; and learning-analytics dashboards that render learner behavioural data visible to learners themselves, not only to instructors, as a precondition for productive self-monitoring. This literature generally supports the proposition that these tools are effective when explicitly aligned to a specific SRL sub-process, and comparatively ineffective when deployed generically.

2.4 Scaffolding and the Gradual Release of Responsibility

Instructional-design literature on scaffolding, and specifically the gradual-release-of-responsibility model, contributes the principle that learner independence should be built through a deliberate, staged transfer of task ownership — from instructor-modelled, through guided, to independent practice — rather than through abrupt exposure to unstructured autonomy. Applied to digital environments, this literature cautions against a common design failure in which digital tools are used to deliver "self-paced" content without any corresponding scaffolded progression in the level of self-regulatory demand placed on the learner, resulting in learners who are technically independent in terms of schedule but not in terms of underlying regulatory skill.

2.5 Measurement of Independent Learning

Existing instruments for measuring self-regulated and independent learning — including self-report questionnaires such as the Motivated Strategies for Learning Questionnaire (MSLQ) and various SRL-specific scales — provide validated measures of learner-reported strategy use and motivation, but are less well integrated with the behavioural trace data increasingly available from digital learning environments (time-on-task, resource-access sequencing, self-assessment attempt patterns). Learning-analytics research has begun to explore trace-data-based measures of self-regulation, but methodological consensus on how to combine self-report and trace-data indicators into a single assessment framework remains limited.

2.6 Synthesis

Taken together, the reviewed literature establishes that (a) SRL and SDT theory provide a well-developed process-level and motivational account of what independent learning requires; (b) digital learning environments possess substantial, but frequently under-realised, capacity to scaffold that process; (c) specific digital-tool classes (adaptive sequencing, self-assessment, e-portfolios, analytics dashboards) each have tool-specific evidence for supporting particular SRL sub-processes; and (d) a structured methodology that deliberately sequences digital-tool use against a staged, gradual-release model of autonomy transfer — rather than assuming digital delivery is itself sufficient — has not been widely formalised in the literature. This gap motivates the methodology proposed in this paper.

3. RESEARCH GAP AND OBJECTIVES

3.1 Research Gap

Three specific gaps emerge from the literature reviewed in Section 2. First, there is a conceptual gap: digital learning environments are frequently treated as autonomy-enabling by default, without a structural account of how specific tool features map onto specific self-regulatory sub-processes (forethought, performance, self-reflection). Second, there is a methodological gap: while individual digital-tool classes (adaptive LMS, self-assessment tools, e-portfolios, analytics dashboards) each have supporting evidence, there is limited guidance on how to sequence them across a staged, gradual-release progression from

instructor-directed to independent learning, appropriate for institutions with varying digital-infrastructure maturity. Third, there is an assessment gap: existing instruments tend to rely on self-report (e.g., MSLQ-type questionnaires) or, separately, on digital trace data, rather than an integrated framework that combines both to assess independent-learning development.

3.2 Objectives of the Study

- To develop a conceptual framework that structurally integrates self-regulated learning theory with digital-learning-environment design for the deliberate development of independent learning activities.
- To design a phase-wise, replicable methodology — grounded in the gradual-release-of-responsibility model — for sequencing digital-tool use to progressively transfer regulatory responsibility from instructor to learner.
- To construct an independent-learning competence matrix specifying indicators, aligned self-regulatory sub-processes, and supporting digital tools, suitable for use by curriculum designers and quality-assurance documentation.
- To propose an integrated assessment and rubric architecture capable of combining self-report and digital trace-data indicators of independent learning.
- To outline a validation strategy for future empirical piloting of the proposed methodology across course and programme contexts.

4. PROPOSED METHODOLOGY

This section presents the Independent Learning Activity Development (ILAD) methodology. The methodology is presented in three layers: (i) a conceptual framework describing the structural relationship between inputs, the self-regulated-learning support engine, and the two competence strands that constitute independent learning; (ii) a competence-mapping matrix specifying measurable indicators aligned to self-regulatory sub-processes; and (iii) a five-phase operational design protocol that translates the conceptual framework into an implementable course- or programme-level process.

4.1 Conceptual Framework

Figure 1 presents the ILAD conceptual framework. The framework treats curriculum and learning-outcome statements, the available digital learning environment (LMS and associated tools), and the learner's baseline self-regulation profile as three converging inputs to a central Self-Regulated Learning Support Engine, operationalised as a scaffolded autonomy-support cycle. This engine distributes instructional design activity across two parallel but interlinked strands — the cognitive-strategic strand (goal setting and planning, resource selection and research, task-strategy application) and the metacognitive-regulatory strand (self-monitoring via digital tools, reflective journaling/e-portfolio work, self-evaluation and adjustment). The two strands converge at an Autonomous Learning Behaviour Synthesis stage, in which cognitive-strategic and metacognitive-regulatory performance data are jointly reviewed, producing a learner profile that is explicitly self-directed and digitally literate, rather than merely digitally active.

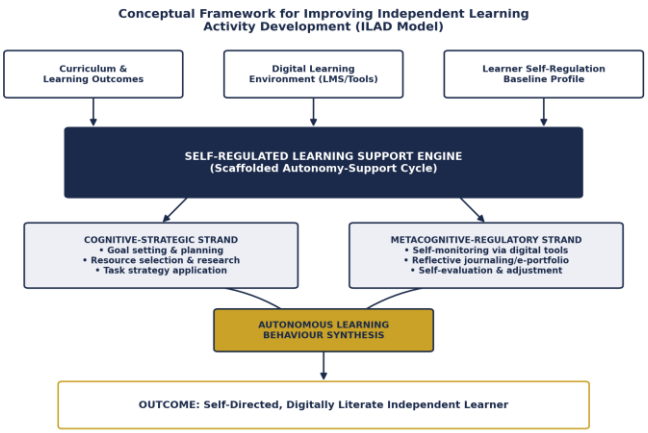

Figure 1. Conceptual Framework for Improving Independent Learning Activity Development (ILAD Model).

Table 1 contrasts the conventional, digital-delivery-only approach to independent learning with the improved, scaffolded approach proposed in this methodology, clarifying the structural shift the ILAD model is intended to produce.

Table 1. Comparison of Conventional Digital-Delivery and ILAD-Scaffolded Approaches to Independent Learning.

Dimension	Conventional Digital-Delivery Approach	ILAD Scaffolded Approach
Role of digital environment	Content repository and administrative platform	Deliberate scaffold for cognitive-strategic and metacognitive-regulatory processes
Autonomy transfer	Assumed present from the outset ("self-paced" by default)	Gradually released across phases, matched to learner readiness
Feedback mechanism	Instructor-graded feedback at task completion	Continuous self-assessment plus instructor feedback, visible to the learner in real time
Reflection component	Optional or absent	Structured e-portfolio/reflective journaling embedded in every cycle
Assessment of independence	Inferred from completion/grades only	Directly measured via combined self-report and digital trace-data indicators
Learner readiness variation	Not explicitly accommodated	Diagnosed in Phase I and used to calibrate scaffolding intensity

4.2 Independent-Learning Competence Matrix

Table 2 operationalises the two competence strands into specific domains, illustrative performance indicators, the self-regulatory sub-process (per Zimmerman's model) each domain is drawn from, and the digital technologies through which each domain is supported and measured within the proposed methodology.

Table 2. Independent-Learning Competence Matrix — Domains, SRL Sub-Processes, and Digital-Technology Alignment.

Competence Strand	Domain	SRL Sub-Process	Supporting Digital Technology
Cognitive-Strategic	Goal setting & planning	Forethought	Digital goal-setting/planning template within LMS
Cognitive-Strategic	Resource selection & research	Forethought / Performance	Curated digital resource library; guided search modules
Cognitive-Strategic	Task strategy application	Performance	Adaptive task sequencing; strategy-prompt overlays
Metacognitive-Regulatory	Self-monitoring	Performance (self-observation)	Learning-analytics dashboard; progress trackers
Metacognitive-Regulatory	Reflective journaling	Self-reflection (self-judgment)	E-portfolio / digital reflective journal
Metacognitive-Regulatory	Self-evaluation & adjustment	Self-reflection (self-reaction)	Digital self-assessment/quiz tools with immediate feedback
Integrated	Autonomous task completion under reduced guidance	Full SRL cycle	Combined LMS + analytics + e-portfolio feedback loop

4.3 Five-Phase Operational Design Protocol

The ILAD methodology is operationalised through a five-phase protocol (Figure 2) — Diagnose, Structure, Equip, Enact, Reflect — explicitly designed around the gradual-release-of-responsibility principle discussed in Section 2.4, such that the degree of instructor direction decreases and the degree of learner self-regulatory responsibility increases across the Enact phase in particular.

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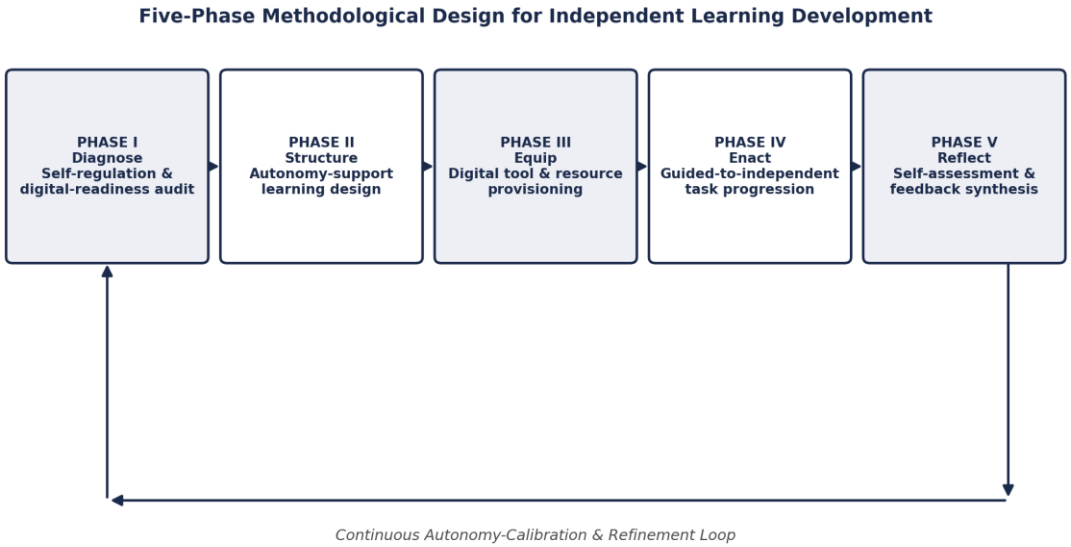

Figure 2. Five-Phase Methodological Design for Independent Learning Activity Development.

Table 3 details the activities, digital-technology inputs, deliverables, and indicative duration for each phase, calibrated to a typical course operating within a semester-length instructional cycle.

Table 3. Phase-Wise Activities, Digital-Technology Inputs, and Deliverables of the ILAD Methodology.

Phase	Key Activities	Digital-Technology Input	Deliverable	Indicative Duration
I. Diagnose	Baseline self-regulation and digital-readiness assessment (e.g., MSLQ-type instrument); learner profiling	Digital self-report survey via LMS	Learner self-regulation baseline report	Weeks 1–2
II. Structure	Design of scaffolded task sequence; mapping of competence indicators (Table 2) to course units; goal-template design	Course-mapping template; goal-setting template build	Autonomy-support instructional blueprint	Weeks 3–4
III. Equip	Configuration of adaptive pathways, self-assessment tools, and e-portfolio structure; orientation of learners to digital tools	Adaptive LMS configuration; e-portfolio setup; tool-orientation module	Configured digital learning environment; learner tool competence check	Weeks 5–6
IV. Enact	Guided-to-independent task progression across the semester, with instructor scaffolding intensity reduced at defined checkpoints	Adaptive LMS delivery; self-assessment tools; analytics dashboard	Task completion records; interim autonomy logs	Weeks 7–13
V. Reflect	Structured self-assessment and reflective synthesis; instructor feedback integration; iterative refinement	E-portfolio final entries; combined rubric scoring in LMS	Independent-learning competence record; refinement report feeding back to Phase I	Weeks 14–15

As shown in Figure 2, Phase V reflection data are explicitly routed back into Phase I of the subsequent instructional cycle, so that the learner's self-regulation baseline and the scaffolding calibration are updated iteratively across successive courses or semesters rather than being treated as a single, static diagnostic.

5. DIGITAL LEARNING ENVIRONMENT INTEGRATION FRAMEWORK

Building on the competence-mapping matrix (Table 2), this section elaborates the architecture through which the four digital-tool classes central to the ILAD methodology — adaptive LMS/personalised pathways, digital self-assessment tools, e-portfolios/reflective journals, and learning-analytics dashboards — are structurally connected to a single learner autonomy record, and, through it, to independent task engagement (Figure 3).

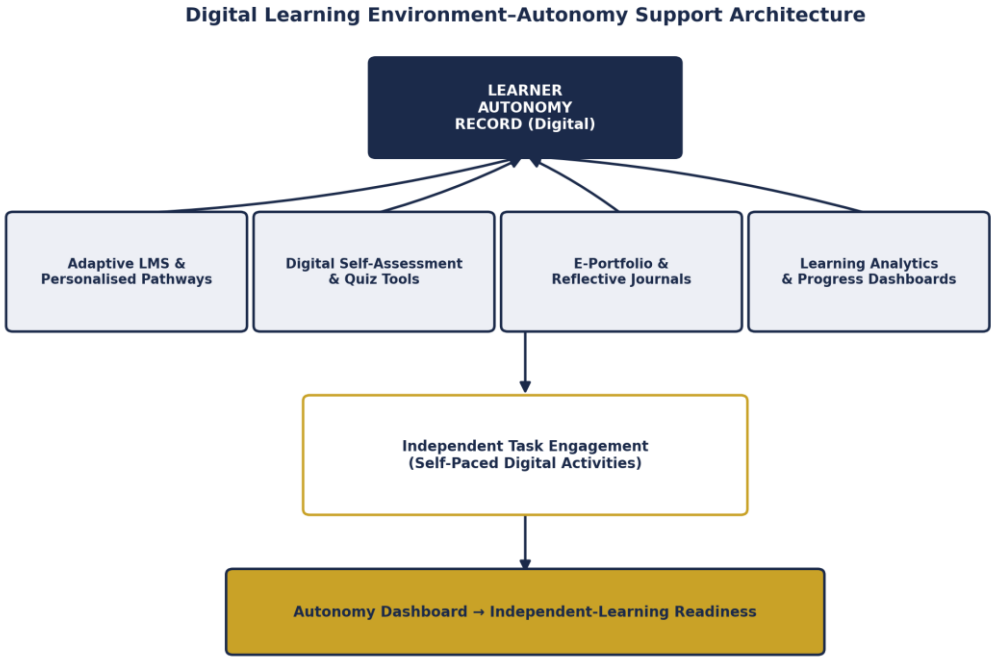

Figure 3. Digital Learning Environment–Autonomy Support Architecture.

5.1 Role of Each Digital-Tool Class

5.1.1 Adaptive LMS and Personalised Learning Pathways

Within the ILAD methodology, the adaptive LMS functions as the structural backbone of the forethought phase: it hosts goal-setting and planning templates, sequences content and tasks according to learner readiness rather than a fixed cohort pace, and routes learners with lower baseline self-regulation (identified in Phase I) through additional planning scaffolds before independent tasks are released, consistent with the gradual-release principle discussed in Section 2.4.

5.1.2 Digital Self-Assessment and Quiz Tools

Low-stakes, immediate-feedback self-assessment tools are positioned within the performance phase of the SRL cycle, allowing learners to self-observe their understanding before formal, graded assessment. Within the ILAD design, these tools are deliberately placed at defined checkpoints within the Enact phase (Table 3) rather than only at unit end, so that self-monitoring becomes a recurring behaviour embedded in the task sequence rather than an occasional add-on.

5.1.3 E-Portfolios and Reflective Journals

E-portfolios operationalise the self-reflection phase of Zimmerman's SRL model, providing a structured, cumulative space in which learners record self-judgments about their performance and self-reactions that inform planning for subsequent tasks. Within the ILAD protocol, reflective entries are explicitly scaffolded with guiding prompts in the early Enact phase (e.g., "What strategy did you use, and how effective was it?") and progressively opened to free-form reflection as the phase advances, mirroring the reduction in instructor-provided structure central to the gradual-release model.

5.1.4 Learning-Analytics Dashboards

Aggregated data from the LMS, self-assessment tools, and e-portfolio activity feed an analytics layer that renders behavioural indicators — time-on-task, resource-access patterns, self-assessment attempt frequency, reflective-entry consistency — visible to learners themselves as well as instructors, consistent with the literature's emphasis (Section 2.3) that self-monitoring is only productive when learners have direct access to their own trace data, not only when that data is used solely for instructor-side monitoring. The dashboard also flags learners whose self-report and behavioural-trace indicators diverge (e.g., high self-reported confidence but low actual task engagement) for targeted instructor attention.

5.2 Tiered Adoption for Institutions with Varying Digital Infrastructure

Recognising that institutions vary substantially in LMS sophistication and available tooling, the methodology is specified as tiered rather than all-or-nothing. A baseline tier requires only a standard LMS with manually configured goal-setting and reflection templates; an intermediate tier adds structured digital self-assessment and a dedicated e-portfolio tool; and a full tier adds adaptive-pathway functionality and a learning-analytics dashboard. Institutions are expected to enter at whichever tier their infrastructure supports and to progress upward across implementation cycles, with the competence matrix (Table 2) and phase-wise protocol (Table 3) remaining structurally unchanged across tiers — only the specific digital-tool input for each activity changes.

6. INSTRUCTIONAL IMPLEMENTATION DESIGN

6.1 Task-Cycle Structure

At the level of an individual learning task, the methodology specifies a recurring four-segment structure intended to operationalise the self-regulated learning support engine described in Section 4.1: (i) a brief digital planning segment, in which learners set a task-specific goal and select a strategy using the LMS planning template; (ii) an independent task-execution segment, completed at the learner's own pace within the adaptive pathway; (iii) a digital self-assessment segment, in which learners check their understanding via low-stakes quiz tools immediately after task completion; and (iv) a reflective-journaling segment, in which learners record a structured e-portfolio entry evaluating their strategy's effectiveness and identifying an adjustment for the next task cycle.

6.2 Instructor Role and the Gradual Release of Direction

The methodology explicitly specifies a changing instructor role across the Enact phase (Table 3), operationalising the gradual-release-of-responsibility model discussed in Section 2.4. Early task cycles involve instructor-modelled goal-setting and strategy selection, delivered through worked examples embedded in the LMS; mid-phase cycles involve instructor-provided guiding prompts within the self-assessment and reflection segments; and late-phase cycles remove structured prompts, requiring learners to initiate planning and reflection independently, with the analytics dashboard (Section 5.1.4) used by instructors to identify learners who may need additional, individualised scaffolding at this stage rather than a return to whole-class direction.

6.3 Institutional Resourcing Considerations

Implementation is expected to require coordination across three institutional functions: the teaching faculty (task and prompt design), the digital-learning/IT support unit (LMS configuration, adaptive pathway and analytics setup), and the academic/curriculum committee (learning-outcome alignment and quality-assurance documentation). The methodology recommends that institutions pilot the protocol within a single course before scaling across a programme, given the design and configuration effort required in Phase II and Phase III (Table 3).

6.4 Illustrative Application Across Disciplinary Contexts

Although presented generically, the methodology is intended to be discipline-agnostic. Table 4 illustrates how the same phase-wise structure and digital-tool classes would be instantiated differently across three representative disciplinary contexts, to clarify that the framework specifies a process architecture rather than discipline-specific content.

Table 4. Illustrative Instantiation of the ILAD Methodology Across Representative Disciplinary Contexts.

Disciplinary Context	Independent Learning Focus	Primary Digital-Tool Application	Illustrative Task Cycle
Undergraduate Business/Management	Independent case analysis and strategic argumentation	Adaptive case-library pathway; structured e-portfolio for analysis journals	Plan a case-analysis approach, work through the case independently, self-check reasoning via a diagnostic quiz, then journal on argument strengths/weaknesses
Engineering/Technical Coursework	Independent problem-solving and self-diagnosis of errors	Digital self-assessment with worked-solution feedback; analytics on attempt patterns	Set a solving strategy, attempt a problem set independently, use immediate self-assessment feedback to identify error patterns, then reflect on strategy adjustment
Language and Communication Studies	Independent skill practice and self-monitored fluency development	Adaptive skill-practice modules; reflective journal on communication attempts	Select a practice focus, complete self-paced practice activities, self-rate performance against a rubric, then journal on next-cycle goals

7. ASSESSMENT AND EVALUATION FRAMEWORK

Consistent with the objective of combining self-report and digital trace-data indicators (Section 3.2), the methodology proposes a four-level integrated rubric applied to each competence domain identified in Table 2, replacing the conventional practice of inferring independence solely from task-completion or grade data.

Table 5. Integrated Four-Level Independent-Learning Assessment Rubric.

Level	Descriptor	Cognitive-Strategic Indicator	Metacognitive-Regulatory Indicator
Level 1 – Dependent	Requires continuous external direction	Cannot set a task goal or select a strategy without instructor prompting	Does not engage with self-assessment or reflection tools unless required
Level 2 – Emerging	Performs with structured prompts	Sets goals/selects strategies only when guided by a template or prompt	Completes self-assessment and reflection only in prompted, structured form
Level 3 – Independent	Performs autonomously to a defined standard	Sets appropriate goals and strategies without prompting	Initiates self-assessment and produces substantive, unprompted reflective entries
Level 4 – Self-Directed	Performs autonomously and adapts across contexts	Adjusts goals/strategies proactively based on self-monitoring data	Uses analytics/self-assessment data proactively to redirect own learning approach

7.1 Assessment Instruments

- Digital self-report instrument: an SRL-oriented questionnaire (e.g., MSLQ-type items) administered via the LMS at Phase I (baseline) and Phase V (post-cycle), scored against the cognitive-strategic and metacognitive-regulatory indicators in Table 5.
- Behavioural trace-data indicators: LMS/analytics-derived measures (goal-template completion, self-assessment attempt frequency, reflective-entry timing and length) used as corroborating, not substitute, evidence for self-report scores.

- E-portfolio review: instructor evaluation of reflective-journal entries against Table 5 descriptors, assessing depth of self-judgment and self-reaction rather than mere completion.
- Autonomy dashboard review: a cumulative, LMS-hosted record combining self-report, trace-data, and portfolio-review scores, reviewed at defined checkpoints within the Enact phase (Table 3) rather than only at course completion.

7.2 Independent-Learning Readiness Threshold

The methodology proposes that a learner be considered to have reached independent-learning readiness for a given competence domain upon attainment of at least Level 3 (Independent) on both the cognitive-strategic and metacognitive-regulatory indicators, operationalising the "Independent-Learning Readiness" output shown in Figure 3. Institutions retain discretion to set domain-specific weighting consistent with their own learning-outcome frameworks; the methodology specifies the structure of the threshold rather than a universal numeric cut-off, since the appropriate pace of autonomy transfer will differ across learner populations and disciplinary contexts.

8. VALIDATION STRATEGY FOR FUTURE EMPIRICAL PILOTING

This paper presents the ILAD methodology at the level of conceptual and procedural design; it does not report primary empirical outcome data. This section specifies a validation strategy intended to guide subsequent empirical work by the authors and other researchers seeking to test the methodology's effectiveness.

8.1 Expert/Content Validation

Prior to field piloting, the competence matrix (Table 2), phase-wise protocol (Table 3), and assessment rubric (Table 5) should be reviewed by a panel of educational-technology and self-regulated-learning experts using a structured content-validity procedure (e.g., a content validity ratio approach), with revision cycles until acceptable consensus is reached on indicator relevance and clarity.

8.2 Pilot Implementation Design

A quasi-experimental pilot is recommended, comparing a cohort receiving ILAD-methodology instruction against a comparable cohort receiving conventional digital-delivery instruction within the same course and institution, controlling for instructor and baseline self-regulation where feasible. Outcome measures should include rubric-based independent-learning scores (Table 5), pre–post change on a validated SRL self-report instrument, and behavioural trace-data indicators, collected via the digital learning environment itself.

8.3 Resource-Tier Sensitivity Testing

Given the tiered-adoption design described in Section 5.2, piloting should be conducted across at least two resource tiers (e.g., baseline LMS-only versus full-tier adaptive-plus-analytics) to establish whether reported outcome differences are attributable to the methodology's structural design or to the specific digital-tool tier deployed, informing institutions with differing infrastructure levels.

8.4 Longitudinal Tracking

Because the methodology's feedback loop (Figure 2) is intended to operate across successive instructional cycles, validation should ideally include longitudinal tracking of at least two to three course cycles to assess whether the scaffolded autonomy-transfer mechanism produces measurable improvement in independent-learning readiness over time, rather than relying solely on single-cycle, cross-sectional comparison.

9. EXPECTED OUTCOMES AND DISCUSSION

9.1 Anticipated Outcome Indicators

While outcome data await empirical piloting (Section 8), the methodology's design logic generates a set of anticipated indicators against which future pilot results can be interpreted, summarised in Table 6.

Table 6. Anticipated Outcome Indicators for Empirical Validation of the ILAD Methodology.

Indicator	Conventional Baseline (Typical Reported Pattern)	ILAD-Anticipated Direction of Change	Primary Data Source
Unprompted goal-setting frequency	Low outside instructor-required checkpoints	Increase, via staged withdrawal of prompts (Section 6.2)	LMS goal-template logs
Self-report vs. trace-data divergence	Not typically measured jointly	Earlier detection via analytics flagging (Section 5.1.4)	Autonomy dashboard
Reflective-entry depth/substantiveness	Often minimal or compliance-oriented	Improvement via scaffolded-to-free-form prompt progression (Section 5.1.3)	E-portfolio review (Table 5)
Documented evidence for learning-outcome quality assurance	Often indirect/grade-inferred	Improved traceability via combined self-report/trace-data records	LMS autonomy record

9.2 Theoretical Implications

The ILAD methodology contributes to the self-regulated learning literature by proposing that digital-tool deployment be explicitly mapped onto SRL sub-processes and sequenced according to a gradual-release logic, rather than treated as a generically autonomy-enabling condition — formalised through the "autonomous learning behaviour synthesis" mechanism in Figure 1 and the divergence-flagging function in Section 5.1.4. This reframes digital learning environment design in independent-learning research from an infrastructural precondition to an active, staged pedagogical intervention.

9.3 Practical Implications

For institutions, the tiered-adoption design (Section 5.2) is intended to make the methodology actionable regardless of current LMS sophistication, while the direct mapping of Table 2 indicators onto SRL sub-processes is intended to support learning-outcome documentation for quality-assurance and accreditation purposes. For instructors, the explicit specification of a changing instructor role across the Enact phase (Section 6.2) is intended to address a commonly reported concern in the literature — that learners are given digital autonomy prematurely, without a corresponding, deliberate reduction in scaffolding calibrated to their demonstrated readiness.

9.4 Policy Implications

At a systems level, the methodology's phase-wise, tiered structure offers policymakers and quality-assurance bodies a template against which institutional digital-learning-environment design could be assessed for its actual (rather than assumed) contribution to independent-learning development, supporting more targeted investment in digital infrastructure that is pedagogically, not merely administratively, oriented.

10. LIMITATIONS

- This paper presents a conceptual and methodological framework and does not report primary empirical outcome data; effectiveness claims should be treated as hypotheses for the validation strategy proposed in Section 8, not as established findings.
- The methodology assumes a minimum baseline digital infrastructure (at least a functioning LMS); institutions below this baseline tier would require a preliminary infrastructure-development phase not detailed in this paper.
- Discipline-specific adaptation (Section 6.4) requires subject-matter and instructional-design input for each context; the generic framework presented here does not substitute for that context-specific design work.
- The proposed assessment rubric (Table 5), while structurally integrated, requires empirical reliability and validity testing (e.g., inter-rater reliability for portfolio review, and convergent validity between self-report and trace-data indicators) before adoption in high-stakes assessment decisions.

- Instructor readiness to enact a deliberately changing, reduced-direction role across the Enact phase, while specified at a design level (Section 6.2), is acknowledged as a change-management factor whose empirical influence on implementation fidelity is a matter for future research.

11. CONCLUSION AND FUTURE SCOPE

This paper has proposed the Independent Learning Activity Development (ILAD) methodology, a structured, five-phase approach for the deliberate development of independent learning in students within digital learning environments, in which digital tools — adaptive LMS pathways, self-assessment tools, e-portfolios, and learning-analytics dashboards — are explicitly mapped onto self-regulated learning sub-processes and sequenced according to a gradual-release-of-responsibility logic, rather than assumed to produce learner autonomy simply by virtue of enabling self-paced access. The methodology contributes a conceptual framework (Figure 1), an independent-learning competence matrix (Table 2), a phase-wise operational protocol (Figure 2, Table 3), a digital-environment integration architecture (Figure 3), and an integrated assessment rubric (Table 5), together with a tiered-adoption design intended to accommodate institutions with differing digital-infrastructure maturity.

Future work should prioritise the empirical validation strategy outlined in Section 8, beginning with expert content validation of the competence matrix and rubric, followed by quasi-experimental piloting across at least two resource tiers and, ideally, longitudinal tracking across successive course cycles. Extensions of this work could also explore discipline-specific adaptations of the methodology (building on Section 6.4), the integration of generative-AI-based dialogic tutoring to support the reflective-journaling segment described in Section 6.1, and comparative studies across institutional and national higher-education contexts to assess the methodology's generalisability.

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AUTHOR CONTRIBUTIONS

Esanmurodov Otamurod Boboqand O'g'li: Conceptualization, Methodology, Writing—Original Draft.

Aliboyev Sobir: Methodology, Formal Analysis, Visualization.

Dr. Parthasarathi Murugesan: Supervision, Project Administration, Validation, Writing—Review & Editing.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this manuscript.

ETHICS STATEMENT

Ethical approval was not required for this study as it is a conceptual and methodological paper that did not involve human participants or the collection of primary data.

DATA AVAILABILITY STATEMENT

Data supporting the findings of this study are available from the corresponding author upon reasonable request.

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