

Teaching Through the Learner's Generative Language: An Inquiry into Knowledge Formation

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Abstract

Educational inquiry develops within historically formed capacities for perceiving, interpreting, questioning, and acting. This paper examines a pedagogical relation in which a teacher offers a question, form, practice, or material possibility that a learner can develop through an evolving repertoire of resources and activities. Drawing on pragmatist education, sociocultural development, critical pedagogy, intellectual emancipation, situated learning, transactional reading, and culturally situated design, the paper proposes *generative invitation* as a comparative concept for studying educational offerings and learner-directed knowledge formation. A learner's *generative language* refers to historically situated linguistic, representational, embodied, practical, and relational resources through which inquiry becomes possible. The analysis separates the conditions of a pedagogical offering, its actual uptake, and subsequent outcomes, including immediate achievement, expanded participation, durable investigative capacities, and collective transformation. It examines how these outcomes relate to educational guidance, epistemic justification, cultural interpretation, and the distribution of authority over resulting knowledge. A shared constructed case is analyzed through productive disciplinary engagement, its power-sensitive extension, knowledge building, and the proposed sequence of offering, uptake, transformation, and continuation. The framework is a revisable comparative perspective whose explanatory economy and practical discrimination remain open to empirical assessment.

Keywords: generative invitation; generative language; educational philosophy; knowledge formation; learner autonomy; culturally situated pedagogy

Discussion Paper Note

This philosophical preprint examines knowledge formation through learners' historically developed generative languages. It forms the third study in a four-paper research sequence concerned with poetic and aesthetic unfolding, generative invitation, education, and heterogeneous value co-creation. The present investigation considers how a teacher's offering becomes available for learner-directed inquiry and how educational knowledge may be developed, justified, and carried into subsequent practices.

The paper draws on established traditions in pragmatism, sociocultural development, critical pedagogy, intellectual emancipation, and situated learning. Its proposed contribution concerns the analytical continuity among an educational offering, its uptake, the transformation of inquiry, and the later access, correction, and reuse of its results. The cases are constructed for conceptual comparison. The framework is open to critical discussion and empirical assessment.

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Educational practice involves responsibilities concerning learner participation, cultural recognition, accessibility, safeguarding, and the treatment of knowledge contributed by learners and communities. The proposed concept of generative invitation is intended for scholarly interpretation and responsible educational design. Applications call for context-specific assessment of consent, disciplinary standards, institutional authority, and the consequences of disclosure or reuse.

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Evidence and scope. The educational scenarios are constructed philosophical cases. The manuscript offers conceptual distinctions and proposals for possible evaluation; it reports no original classroom study or established intervention effect. The companion source package records bibliographic and claim-level verification, including the evidence limits of individual checks.

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Intellectual lineage. Citations acknowledge substantive contributions from the relevant educational and philosophical traditions. Their inclusion reflects intellectual engagement with these sources and implies neither personal collaboration nor endorsement.

1 Introduction

This paper examines teaching through the relation between educational offerings and a learner's developing capacity to form knowledge. A teacher may introduce a problem, representation, artifact, practice, or occasion for inquiry. Its meaning emerges through the learner's historically developed skills, concepts, relationships, and opportunities for participation. The resulting activity may yield a warranted answer, enlarge an investigative repertoire, or change the practical conditions of further inquiry. The argument distinguishes these achievements and examines how pedagogical guidance, institutional authority, and the recognition of contributors affect their development. Through philosophical comparison, it advances a provisional generative-relational (GR) account of educational encounters, drawing on pragmatist, sociocultural, critical, emancipatory, transactional, and situated approaches.

Pedagogical encounters involve differences of expertise, access, and responsibility. A teacher may possess disciplinary knowledge that the learner is beginning to acquire, while the learner may possess practical or cultural knowledge unfamiliar to the teacher. Their encounter can support several kinds of educational development. A learner might become proficient in an introduced procedure, use an existing skill to illuminate an unfamiliar problem, formulate an independent question, or participate in changing a shared practice. Similar classroom performances can therefore arise through different histories and lead to different subsequent capacities. Assessing an educational encounter calls for attention to the course of inquiry as well as the response produced at its conclusion.

The expression *learner's generative language* designates the historically situated repertoire through which a learner makes sense, develops questions, coordinates action, and constructs or evaluates possible answers. *Language* is used here in an extended and analogical sense. The repertoire may encompass spoken and written expressions, mathematical and visual representations, embodied skills, technical practices, memories, narratives, social expectations, and relations with people and places. These elements can be combined in different ways across situations. Their educational relevance emerges through what a learner can do with them, how they are understood by others, and how they change through participation. Learners may share a natural language while drawing on different practical histories; they may also communicate across linguistic differences through common technical or embodied practices. The concept directs attention to this evolving organization of resources and activities, including the conditions under which learners can make them available to further inquiry.

Educational offerings enter such histories and may take on significance beyond their initial instructional design. A geometry problem can evoke a method developed through craft; an archival document can raise questions inherited from family memory; a scientific observation can disturb an established account of a local environment. These possibilities motivate the provisional concept of *generative invitation*: a pedagogical offering whose conditions allow a learner meaningful opportunities to interpret, develop, redirect, or decline a proposed line of inquiry. An invitation may consist of a question, artifact, experiment, representation, document, or access to a shared practice. Its significance depends on the encounter between the offering and the learner's available resources, together with the practical authority afforded to the learner. Uptake, intellectual value, and ethical legitimacy are distinct matters for investigation, since a promising offering may yield several different courses of inquiry.

John Dewey's educational philosophy provides a substantial starting point for this investigation. In *Democracy and Education*, reflective activity develops through problems whose consequences can be explored and whose possible resolutions can be tested in further action [16]. The significance of experience is thus connected to the relations learners discern among action, consequence, and subsequent possibilities. In *Experience and Education*, Dewey places continuity and interaction at the center of an account of how present experiences condition those that become available later [17]. The proposed framework takes these insights seriously. Its additional analytical task is to examine how the same educational offering can enter differentiated histories of practice and how subsequent changes in questioning, participation, and control might be described and assessed. Dewey's discussion already asks whether the learner encounters a genuine problem and can pursue its consequences; his chapters on experience and thinking make this an established point of departure. The proposed vocabulary is therefore evaluated by

the additional distinctions it yields concerning how a particular offering is taken up and how access to subsequent inquiry is organized.

Lev Vygotsky's work adds an account of development through mediated activity. The materials assembled in *Mind in Society* address relations among signs, tools, social interaction, internalization, and learning [62]. They draw attention to the capacities exercised with assistance and to the possible developmental significance of participating in forms of activity initially supported by others. From this perspective, observed independent performance carries a history of mediation, and pedagogical assistance can alter the range of activities available to the learner. The present inquiry asks how particular forms of assistance operate within that history: by clarifying a procedure, organizing a task, opening access to a practice, or making room for a learner-generated question. These modes may coexist, and their consequences require attention to what the learner can pursue in later settings.

Paulo Freire's *Pedagogy of the Oppressed* brings the political conditions of educational questions into view. Its treatment of problem-posing education, dialogue, and *generative themes* connects learning with participants' lived circumstances and their capacity to examine those circumstances critically [24]. Questions emerge here through historically situated experience and through relations among people whose opportunities to speak and act are unequally organized. The proposed idea of invitation inherits an interest in the learner's participation in framing problems. It also asks a more specific comparative question: under what conditions does an offered problem become available for independent development, and how can that development be traced? Freire's emancipatory commitments remain important to the ethical appraisal of those conditions, especially where an apparent invitation occurs under constrained participation or unequal authority.

Jacques Rancière offers a different account of educational authority in *The Ignorant Schoolmaster*. Through his reading of Joseph Jacotot's educational experiment, the presupposition of intellectual equality becomes central to the learner's standing as someone capable of attending, comparing, verifying, and speaking [45]. The question concerns the organization of authority over acts of intelligence, including the authority to recognize a learner's understanding. Rancière's emphasis differs from Vygotsky's developmental treatment of mediated activity: one focuses on emancipation and the status of intelligence; the other investigates relations between assistance and development. Reading them together makes a productive tension visible. Pedagogical expertise may provide substantial resources, while the learner's standing to question an explanation or propose a different path remains a matter of educational and political significance.

Learning also takes place through changing participation in material and social practices. Jean Lave and Etienne Wenger analyze legitimate peripheral participation in relation to the organization of communities of practice, including access, identity, and the conditions under which people become participants [35]. These concerns help locate a learner's capacities in shared arrangements. Tools, permissions, recognized expertise, available collaborators, and opportunities to contribute shape what a participant can attempt. A learner's apparent difficulty with an unfamiliar task may involve limited access to such resources alongside questions of prior experience or skill. The proposed generative language is therefore sustained partly through social and material relations. Its development may involve changes in a learner's position within a practice as well as changes in interpretive or technical ability.

Research on culturally situated design provides a concrete example of these relations. Ron Eglash and collaborators describe computational design environments connected with mathematical structures in cultural practices, including beadwork, cornrow hairstyles, and graffiti. Their account also addresses interactions among community members, students, and educators in developing such tools [20]. The examples invite consideration of cultural practices as sites of technical and mathematical inquiry and of educational design as a process of making further exploration possible. The documented projects supply a substantive precedent for the present questions about interpretive access and the development of new representations. Questions of learning over time, authority over representation, and the circulation of resulting benefits call for evidence and normative analysis appropriate to each particular setting.

Louise Rosenblatt's transactional account of reading offers another comparative resource. Her analysis of relations between reader, text, and circumstances of reading, including the aesthetic and efferent

stances, provides a way to consider how a public form can support differentiated interpretive activity [48]. A pedagogical offering may similarly become meaningful through the learner's attention, history, and purposes. Educational inquiry also involves standards that vary with its object: mathematical justification, historical evidence, experimental reliability, and responsible interpretation each place demands on possible responses. A learner can develop a question freely while also learning to revise a proposed answer through evidence and criticism. Generative invitation, as considered here, joins room for intellectual initiative with opportunities to acquire and exercise such standards.

Consider, as a constructed illustration, an introduction to proportional reasoning among learners with experience in decorative design, equipment repair, cooking, or urban navigation. A teacher could begin with a conventional numerical ratio or with an activity drawn from one of these practices. Either offering may open a route toward comparing familiar techniques with mathematical representations. Some learners may extend a demonstrated procedure; others may identify an invariant across examples, develop an alternative representation, or bring forward a question arising from their own experience. These are possible trajectories of inquiry rather than predicted effects of a particular instructional format. Their educational significance would be investigated through the learners' reasoning, the warrant for their conclusions, and the tasks and questions they can subsequently pursue. The illustration also makes interpretation consequential: the teacher's understanding of a learner's practice remains open to correction by the learner and by others familiar with that practice.

Participation in knowledge formation also raises questions of recognition and authority. A teacher may enable an inquiry through carefully chosen materials, while learners contribute interpretations or discoveries developed through their own work. Communities may supply practices and artifacts that inform educational tools, while schools or other organizations exercise authority over their design, evaluation, and circulation. Miranda Fricker's account of epistemic injustice illuminates ways in which persons may encounter unequal credibility or inadequate shared interpretive resources in their capacity as knowers [25]. The present analysis distinguishes acknowledgment of a contribution, evaluation of its epistemic quality, and authority over its later use. These dimensions can be distributed differently among participants. An appraisal of pedagogical invitation therefore considers who can shape the inquiry, contest an interpretation, receive recognition, and take part in decisions about the resulting knowledge.

Guidance introduces a related problem of responsibility. Wood, Bruner, and Ross analyze tutoring in problem-solving interactions and provide a reference point for examining assistance organized around a learner's activity [64]. Scaffolding and invitation may be combined in a single encounter, although they direct attention to different analytical dimensions. Scaffolding concerns forms and adjustments of support; generative invitation emphasizes the learner's opportunities to develop the offering into further inquiry. Their relation can be examined through the learner's scope to reformulate a task, question a premise, seek assistance, and carry a newly acquired capacity into subsequent situations. This comparison requires sensitivity to the responsibilities that remain with an educator, including disciplinary accuracy, safeguarding, and equitable access to educational opportunities.

Gert Biesta's account of educational risk adds a further dimension to the teacher's responsibility. His discussion of education as an encounter with subjects capable of action helps illuminate the uncertainty accompanying a learner's independent response [8]. An invitation may be reinterpreted, declined, or developed in a direction that calls for reconsideration by the teacher and learner. This openness occurs within conditions of time, institutional obligation, access, and care. Educational judgment consists partly in sustaining meaningful opportunities for initiative while attending to the effects of possible actions on participants and others. Such judgment may include redirection, correction, and limits justified by the particular educational situation.

The GR perspective organizes these concerns around historically differentiated conditions of generation. *Generative* refers to the capacity of an encounter to bring forth questions, representations, actions, connections, or practices whose development can be investigated. Their worth depends on further epistemic, practical, and ethical judgments: creative activity can yield insight, error, or harmful consequences. *Relational* directs attention to the resources, encounters, institutions, and environments through which capacities are exercised and modified. The terms provide an analytical orientation for comparing educa-

tional histories. Their use remains provisional, with explanatory adequacy to be tested against existing educational theories and the evidence available in particular cases.

Four types of educational outcome guide the comparison. *Immediate achievement* is the answer or action accomplished in an encounter. *Relational enablement* concerns altered access to people, tools, practices, or occasions for inquiry. *Capacity transformation* concerns comparatively persistent changes in a learner's ability to understand, formulate questions, create, or evaluate further work. *Collective transformation* concerns changes in shared practices or institutions through which inquiry can continue. These outcomes can occur together and may develop on different timescales. A successful project supported by extensive guidance is evidence of achievement under those conditions; a claim about greater independent capacity calls for observations across relevant subsequent activities and consideration of alternative explanations. Comparable attention can be paid to changes in the teacher's understanding and in the wider arrangement of participation.

Interpretive responsibility becomes especially important when a teacher seeks to work through a learner's generative language. Familiarity with some practices or cultural references can support an encounter, while the learner may relate to those practices in ways the teacher has yet to understand. Responsive pedagogy provides opportunities for learners to clarify, revise, or contest the interpretations on which instruction is based. It also attends to their authority concerning the materials and knowledge they bring into a shared setting. A situated translation between teacher and learner can therefore be assessed through mutual intelligibility, the possibility of correction, and the consequences of decisions about representation and use. These conditions connect educational understanding with participation and recognition.

Artificial tools can participate in these encounters by offering problems, adapting representations, generating examples, or supporting the examination of conjectures. Their pedagogical significance can be studied through the quality of assistance, the forms of authority they exercise or are assigned, the data they use, and the capacities learners develop through subsequent activity. Relevant questions concern accessibility, reliability, appropriate reliance, privacy, and the distribution of responsibility among educators, learners, and institutions. The standing of artificial systems as possible subjects of experience or normativity remains a separate philosophical question. The present inquiry concentrates on the educational relations and observable consequences of their use, including the learner's opportunity to understand and critically assess an artificially generated contribution.

The paper brings these educational traditions into a focused comparison of generative conditions, pedagogical offerings, and trajectories of inquiry. Dewey clarifies reflective experience; Vygotsky illuminates mediation and development; Freire and Rancière address distinct dimensions of educational emancipation; Lave and Wenger examine participation; Rosenblatt analyzes interpretive transactions; and Eglash and collaborators describe concrete culturally situated designs. Generative invitation is proposed as a way of asking how an offering enters a learner's repertoire, what latitude the learner has to transform it, and which subsequent capacities or forms of participation become available. Its explanatory value depends on whether these distinctions clarify cases or research questions beyond what established accounts already make visible. In some contexts, its contribution may chiefly be integrative; in others, comparative investigation may identify a more specific analytical role.

The argument develops in six connected movements. Sections 2–4 reconstruct historically situated repertoires and clarify the educator's interpretive responsibilities through established philosophical accounts. Sections 5–6 examine the structure of an invitation and the partial translation of practices through which it becomes intelligible. Sections 7–8 consider warranted inquiry, guidance, and developing autonomy. Sections 9–10 extend the analysis to cultural participation, institutional recognition, and the circulation of resulting knowledge. Section 11 evaluates the concept against rival explanations and specifies researchable distinctions; Section 12 identifies the remaining philosophical questions. Constructed cases make the contrasts explicit, while the learner's continuing capacity for inquiry remains the paper's central concern.

2 The Learner's Generative Language as an Educational Object

A learner's *generative language* names the historically developing repertoire through which that learner can notice, interpret, represent, and transform a situation. This section identifies its linguistic, embodied, material, relational, and institutional dimensions. Language-games, sociocultural mediation, practical knowledge, and situated learning supply distinct interpretive resources for examining the repertoire. The analysis then distinguishes what a learner has learned to do, which opportunities make those capacities available, and how an encounter may reorganize them. This account establishes the object that the subsequent discussion of educational offerings seeks to address.

In an ordinary classroom, the phrase *the learner's language* may refer to a natural language, a dialect, a vocabulary, or familiar modes of expression. These meanings retain their importance. A mathematics lesson offered in an unfamiliar language creates difficulties different from those presented by a familiar language used to introduce unfamiliar mathematical ideas. Yet educational inquiry also involves forms of competence that exceed verbal expression. A learner may recognize a faulty joint by sound, anticipate changes in water pressure through experience with a pump, identify the rhythm of a narrative before explaining its structure, or judge whether a shared workspace permits a particular intervention. Such achievements may involve speech, notation, bodily orientation, instruments, and the expectations of other participants. Calling their configuration a generative language is a philosophical proposal for considering how these resources become available to subsequent acts of questioning and creation. The term describes situated possibilities for inquiry arising through a learner's participation in practical, semiotic, and material relations. For analytical purposes, an account of a particular learner's generative language should specify a relevant activity, a time horizon, and observable or interpretable resources. A repertoire is thereby selected in relation to a question: practical skills, representational conventions, available collaborators, and access to instruments may each matter differently in a laboratory, a workshop, or an archive. The concept gains discriminatory force when it helps identify a particular resource that becomes usable, a relation that changes, or a practice that the learner can subsequently extend. Its descriptive reach remains provisional where those differences cannot be established from the evidence.

Within this inquiry, the expression *generative* has a specific educational meaning. It concerns the possibility of forming further questions, representations, distinctions, experiments, interpretations, or practical arrangements through the exercise and transformation of situated resources. Epistemic warrant and practical consequences are assessed through additional criteria. A false conjecture, an ineffective device, and a harmful project can each be generated through sophisticated capacities. Educational appraisal therefore requires independent accounts of evidence, correction, responsibility, and the value of particular outcomes. A generative language, in the proposed sense, concerns conditions of possible inquiry; the justification of what inquiry produces remains a further problem.

Wittgenstein's later philosophy draws attention to the diversity of practices through which expressions acquire their sense. His examples of language-games situate words within activities such as giving instructions, describing, hypothesizing, narrating, and questioning. The forms of life in which such activities acquire significance are central to the analysis of language use [63]. The educational importance of this account lies partly in its resistance to a single explanatory model of meaning. Responding to an instruction, questioning its purpose, and devising an alternative procedure involve related but distinguishable forms of participation. The language-game approach accordingly illuminates the plurality of practices through which a seemingly common school term is used.

There is also a significant philosophical difference between Wittgenstein's investigations and the present GR proposal. The former illuminate the grammar of familiar practices and the difficulties produced by philosophical demands for generality. The latter provisionally asks how a historically situated configuration of practices may change when a learner encounters unfamiliar forms and other participants. A model of evolving resources can help describe these changes while remaining accountable to the local criteria by which participants understand their practices. Interpretations of Wittgenstein's notion of a form of life differ, including in the relative emphasis placed on shared practices and cultural variation. For the educational question considered here, the pertinent point is that participation histories and

practical relations can affect what a particular offering enables a learner to do.

The sociocultural approach associated with Vygotsky adds a developmental dimension. Signs, tools, interaction, and historically formed practices enter the organization of psychological activity; Vygotsky accordingly examines learning and development through socially mediated participation [62]. This approach supports an inquiry into how a teacher's question can become part of the learner's own activity. It also directs attention to the difference between access to a sign or tool, its effective appropriation, and a learner's ability to use it independently under appropriate conditions. The educational significance of a new representation depends on the forms of use, correction, and further development made possible through the encounter. A GR account can organize these distinctions, while recognizing that sociocultural theories already offer substantial explanations of mediated learning.

Practical knowledge supplies a second indispensable dimension. Ryle's treatment of knowing-how and knowing-that challenges the tendency to describe competent activity as the application of an antecedent list of explicit instructions [50]. In a workshop, a learner may coordinate pressure, movement, material resistance, and the work of others with considerable competence while being unable to provide an exhaustive verbal account of that coordination. A student who can recite a precise rule may still be developing the practical judgment required to apply it as conditions change. The two cases reveal different relationships among expression, skill, and successful participation. Including practical judgment within the proposed generative-language vocabulary directs attention to skilled activity in its situated form, including aspects that resist exhaustive verbal reconstruction.

Material arrangements also help constitute the conditions under which capacities become effective. A measuring instrument, a shared notebook, a hand tool, a diagram, or access to a laboratory can alter which questions are realistically approachable. Familiarity with equipment may involve propositional understanding alongside timing, orientation, maintenance, and sensitivity to signs of unreliable measurement. Suchman's analysis of situated action challenges models that treat conduct as the execution of a complete prior plan, particularly where communication and human-machine interaction depend on locally available circumstances [59]. Her critique provides a reason to treat pedagogical activities as unfolding amid changing material conditions. An account of lasting capacity development additionally requires evidence of subsequent activity and attention to alternative explanations for observed change.

The proposed account distinguishes several intersecting dimensions of a learner's generative language. Its semiotic aspect concerns available expressions and ways of making distinctions. Its practical aspect concerns acquired skills and coordinated activity. Its material aspect concerns tools, spaces, and infrastructures through which an inquiry can be undertaken. Its historical aspect concerns the relations through which competences were acquired and transformed. Its normative aspect concerns expectations governing what counts as an appropriate question, legitimate evidence, responsible action, or competent performance. These aspects are analytical orientations, and they may intersect within a single encounter. They serve as intersecting analytical orientations that make heterogeneous enabling conditions visible within the educational encounter.

The historically formed character of such conditions becomes clearer through Lave and Wenger's account of legitimate peripheral participation. In this approach, learning is bound up with changing participation in communities of practice, including relations among newcomers, more experienced participants, artifacts, identities, and the organization of work [35]. An activity that appears simple to an institution may therefore have different significance within distinct histories of participation. A learner who has helped maintain communal equipment may approach a technical diagram as a way of articulating familiar relationships. A learner whose experience is predominantly textual may initially treat the same diagram as a rule to memorize. These differences can inform educational design while leaving the learner's subsequent understanding open to investigation. Descriptions of participation acquire greater credibility through revision in light of the participant's actual responses.

The relevance of households and community practices is especially well established in educational research on *funds of knowledge*. Moll, Amanti, Neff, and González describe collaborative work connecting household practices with classroom teaching through qualitative investigation, including teacher learning in encounters with families [39]. Their study offers a concrete precursor to the idea that edu-

cators should enter a learner's existing practical world before selecting pedagogical offerings. In such work, the teacher's knowledge of the learner develops through inquiry and participation. The concept of generative language should therefore acknowledge the methodological commitments of ethnographic observation, reciprocal engagement, and interpretive correction. A teacher's speculative description of a student's cultural background is a weak substitute for examining actual practices with the students and participants concerned.

Eglash and collaborators' culturally situated design tools provide a related yet distinctive precedent. Their research examines mathematical and computational structures in cultural practices and develops design tools through which learners may investigate and generate forms informed by those practices [20]. Such work shows how cultural resources can support technical inquiry and creative experimentation as substantive elements of a learning activity. At the same time, the tools, their implementation, and their relation to communities require specific analysis. Questions of participant authority over resulting knowledge and of durable mathematical learning call for additional examination beyond the presence of a culturally familiar design motif. These questions locate generative invitation within the historical and institutional conditions through which educational participation is organized.

An educator's access to a learner's generative language is interpretive and interactional. The teacher encounters the learner through particular activities, tasks, gestures, narratives, and responses. Each selection partly determines which capacities become observable. An examination conducted solely through standard tests is likely to register abilities elicited by those tests. A field observation may disclose other competences while leaving their transfer to unfamiliar situations uncertain. The learner's practical repertoire becomes accessible through situated observations whose selection can itself change the conditions of participation. This is a methodological limitation as well as a condition of pedagogical responsibility.

A constructed case makes the issue concrete. Consider a student who has participated in maintaining a neighborhood water-pumping system. Through repeated assistance the student has learned to notice variations in sound, anticipate fluctuations under changing use, and coordinate with others during repairs. A teacher introduces a graph relating flow rate and pressure, then asks the student to compare the graph with particular situations remembered from maintenance work. A successful encounter might enable the student to formulate a new question about measurement error, to revise an earlier practical explanation, or to identify when the graph's assumptions fail. Such developments become clearer through the learner's subsequent questions, comparisons, and uses of the representation. They depend on how the offering enters an already organized practice and how the student responds. This constructed case illustrates a possible educational encounter and supplies a conceptual example for subsequent evaluation.

The same case reveals several possible failures. The teacher may misunderstand the relevant machinery, impose a graph that represents a different hydraulic system, or dismiss observations whose significance is unfamiliar in the classroom. A polite response may coexist with uncertainty about how the model could be questioned. Conversely, the student's practical experience may contain mistaken assumptions that require substantive correction. A pedagogy sensitive to generative language therefore retains the educator's responsibility for accuracy and the learner's opportunity to challenge the representation. Intellectual respect calls for dialogue capable of accommodating both correction and genuine disagreement. A teacher's familiarity with the student's practice can open a productive inquiry, accompanied by continuing examination of the practice and the claims developed through it.

The pumping-system case illustrates the risk of assigning a stable language to an individual or a community. A person participates in several partially overlapping practices, and their ways of inquiry can vary across circumstances. A community's histories also contain disagreement, unequal access, and changes across generations. Treating one practice as a group's authentic language can suppress internal differences and turn cultural recognition into a new kind of restriction. The label *generative language* should consequently be used locally and provisionally, with the learner's participation in interpreting and revising the description. This requirement is especially significant where institutions have disproportionate power to evaluate competence, authorize knowledge, or distribute opportunities. Fricker's account of epistemic injustice offers a related basis for examining prejudicial credibility deficits and gaps in shared interpretive resources that can undermine participants' standing as knowers [25].

The problem of symbolic description also requires care. The educator may produce a diagram of a practice, a conceptual map of a learner's interests, or a taxonomy of questions that seem meaningful to the learner. Such representations can support communication and curricular decisions. They inevitably preserve selected distinctions while neglecting others. A description of a student's skill in repairing devices might record procedures, outcomes, and verbal explanations while leaving aside the timing of collaborative gestures or the historical circumstances in which the skill was learned. Whether such omissions matter depends on the educational problem under investigation. The representation's adequacy depends on its purpose and on whether the omitted relations are consequential for that purpose. The relevant philosophical task is to identify the transformations under which a selected description remains reliable and the contexts in which its limitations become consequential.

This point supplies a restrained connection with the broader GR study of equivalence and translation. Different learners can perform the same task successfully while drawing on different practical histories. For one educational purpose, their performances may count as equivalent. A different purpose, such as identifying the resources available for independent design, may require a finer comparison. The appropriate equivalence relation is therefore relative to the claim being evaluated. The historical specificity of a learner's participation warrants task-relative comparison. Formal equivalence and quotient constructions can assist such comparisons when the relevant transformations and criteria have been independently specified.

Educational institutions introduce further normative structure. Curricula specify valued competencies; examinations identify acceptable performances; disciplinary communities establish standards of evidence; and teachers exercise judgment when selecting activities. These arrangements partly determine which aspects of a learner's resources receive recognition. A school can widen access to unfamiliar traditions of inquiry while constraining the terms on which a learner may use or criticize them. Shared curricular standards interact with historically specific learner resources, while scientific and historical claims continue to require appropriate evidence and critical examination. Educational normativity comprises the standards through which claims are tested and the institutional procedures through which capacities are recognized. Both can be examined for their epistemic reliability and their consequences for learners' agency.

A teacher who seeks to work through the learner's generative language should thus approach it as a relation to be investigated together with the learner. Inquiry might begin with observing an activity, inviting a description, offering an unfamiliar representation, and examining where correspondence succeeds or fails. The teacher may learn that the initial interpretation was inadequate, that a tool is inaccessible, or that a seemingly relevant example carries unwanted associations. The learner, in turn, may encounter a question that enables previously unarticulated relationships to become available for investigation. Its educational merits can be evaluated through comparisons with effective scaffolding, situated participation, culturally responsive teaching, and other instructional practices. Responsible inquiry combines openness to emerging questions with relevant disciplinary competence and adequate justification of answers.

A learner's generative language can thus be understood as a historically developing configuration of signs, practices, embodied skills, relationships, and material opportunities through which inquiry becomes possible. Its relevant boundaries vary with the activity under investigation, and access to its organization is mediated by situated interpretation. The concept earns its place where it illuminates differences among possessing a resource, demonstrating competence in a task, posing a question, and extending opportunities for further inquiry. The educator therefore encounters a repertoire to be explored with the learner through observation, dialogue, experimentation, and revision of initial judgments. The philosophical accounts considered next help specify the educational and political responsibilities involved in that encounter.

3 Experience, Development, and Intellectual Emancipation in Educational Philosophy

Four educational philosophies illuminate different conditions of learner inquiry: Dewey's account of educative experience, Vygotsky's analysis of socially mediated development, Freire's dialogical problem-posing education, and Rancière's intellectual emancipation. This section reconstructs their central questions and compares the responsibilities they assign to educators and learners. The discussion considers the quality of experience, developmental assistance, the political formation of problems, and the presupposition of intellectual equality. A constructed encounter brings these perspectives into comparison while preserving their substantive disagreements. The comparison supplies a philosophical basis for investigating generative invitation as a specific structure of educational encounter.

The four approaches are sometimes associated with learner-centered or emancipatory teaching, yet those descriptions are too broad to establish theoretical agreement. Experience can be organized so that a learner encounters consequences worth investigating; another participant can mediate an activity beyond the learner's unaided performance; a dialogue can disclose the political organization of a problem; and an educator can proceed from an assumption of intellectual equality. Each claim concerns a different relation between the learner and an educational situation. They may be jointly relevant to an encounter, while yielding divergent judgments about the teacher's power to interpret, explain, direct, and evaluate. Their differences offer a useful test of whether the expression *learner's generative language* contributes any additional analytical precision.

Dewey's philosophy treats experience as an educational category whose significance depends on the inquiry and subsequent development it makes possible. In *Democracy and Education*, the movement from an indeterminate practical situation through observation, proposed solutions, and testing helps explain why the learner's activity matters to intelligent learning [16]. A relevant experience confronts the participant with an unsettled relation among purposes, available means, and anticipated consequences. The participant has reason to investigate because something within the activity calls for further determination. Educational reflection therefore involves disciplined attention to conditions and results. A familiar practice can become a source of inquiry when its organization affords a genuine problem, and an unfamiliar practice can become intelligible through guided engagement with its consequences.

The emphasis on experience also requires a criterion for selecting among experiences. In *Experience and Education*, Dewey develops continuity and interaction as mutually related criteria of educational significance (chapter 3, especially pp. 43–45 in the commonly reprinted pagination) [17]. Continuity concerns the bearing of an experience on further experience: activities can enlarge or constrain the habits and possibilities through which subsequent situations are approached. Interaction concerns the relation between the participant's conditions and those of the surrounding environment. Together, these principles draw attention to the quality of the educational situation and the possibilities it sustains. Enthusiasm, task completion, and a favorable classroom atmosphere offer partial indications of educational experience; inquiry across changing situations provides an additional basis for assessment.

This conception supports a first criterion for generative invitation. An offering may be educationally consequential when its encounter with a learner's existing practices helps generate questions, testing procedures, or habits of judgment that can be carried into other problems. The teacher's selection of materials and conditions matters because the ensuing experience depends partly on what the learner can observe, manipulate, and contest. To respect a learner's history is consequently more demanding than choosing an example recognizable to that learner. The educator can examine how an example permits inquiry into consequences, invites criticism of explanations, and extends the learner's subsequent freedom to investigate. In Deweyan terms, the educational appraisal extends from the attractiveness of a situation to the quality of the experience it enables.

Dewey's account also complicates simple oppositions between teacher direction and learner freedom. A teacher exercises practical judgment in constructing environments, selecting resources, recognizing a developing problem, and supporting the testing of conjectures. Such judgment can be authoritative through its responsiveness to evidence and to the learner's changing purposes. Its exercise also deserves

scrutiny: the educator may organize experience according to assumptions the learner has little opportunity to challenge. The relevant question is how curricular organization affects the learner's developing ability to participate intelligently in inquiry. Learners' opportunities depend partly on access to relevant instruments, interpretive assistance, and meaningful scope to investigate the offered problems. Dewey thus supplies criteria for evaluating the organization and continuity of experiences, including activities described as learner-led.

Vygotsky's treatment of the relation between learning and development places a different distinction at the center of educational inquiry. In the edited collection *Mind in Society*, the analysis of socially mediated psychological processes and the zone of proximal development relates a learner's independent activity to forms of problem solving possible through guidance or collaboration [62]. The distinction makes the relevant developmental question more specific than the learner's present success or failure on a task. It directs attention to the organization of cooperation, the cultural tools involved, and the processes through which initially mediated activities may become available in changed forms of independent action. The analysis situates the formulations of the edited 1978 volume within their editorial and historical context and uses them for the specific educational comparison at issue.

This perspective illuminates the role of a pedagogical offering as a mediated opportunity. A symbol, instrument, demonstration, or collaborative procedure can modify the activity available to a learner. Suppose a student can estimate the behavior of a device from sound and prior maintenance experience but has difficulty interpreting a formal graph of its operation. Joint comparison of measurements with observed states may permit the student to make distinctions that were initially inaccessible through the graph alone. With further participation, the student might use a graph to pose and examine a new problem independently. The philosophically important question concerns the process by which a relation organized through assistance becomes a resource for further action. Sustained and responsive mediation can contribute to development alongside the learner's existing concerns, relations, and emerging questions.

The distinction between assisted performance and relatively independent capacity makes Vygotskian mediation pertinent to the evidential standards of this paper. Successful completion of an exercise with carefully timed prompts shows what became possible within that configuration of support. Subsequent attempts under altered conditions help test whether the learner has acquired resources that can be reorganized independently. Even then, independent activity remains materially and socially situated: access to texts, tools, collaborators, and institutions can be among its enabling conditions. A developmental interpretation requires attention to the kind of assistance provided, the task's demands, the history of participation, and the criterion used to judge transfer. The zone of proximal development supplies an orientation for studying changing relations between assisted and independent activity; its empirical applicability is a matter for situated investigation.

The vocabulary of a learner's generative language can clarify the resources involved in mediation through a provisional, task-relative description. An observed failure to explain a phenomenon in disciplinary notation may coexist with a sophisticated practical ability to predict it. An observed success after guided modeling may reflect a newly accessible conceptual relation, temporary accommodation to the teacher's prompts, or the use of an external tool. Treating these alternatives as different outcomes prevents the generative-language metaphor from assigning a comprehensive capacity on the basis of one classroom event. It also makes room for a learner's own interpretation of what has changed: the same tool can be experienced as enabling, intrusive, unreliable, or irrelevant, and its effects may vary across encounters.

Freire develops a more explicitly political inquiry into the educational relation. In *Pedagogy of the Oppressed*, his account of banking education, problem-posing education, dialogue, and generative themes connects classroom practices to relations of domination and to the possibility of collective critical agency [24]. The object of inquiry includes whose experiences are treated as sources of problems, who determines the terms of discussion, and how participants can investigate the historical conditions shaping their situations. Pedagogical dialogue here bears a normative and political significance that extends beyond the exchange of opinions or the improved delivery of curricular material. The participants' relation to the world under investigation becomes part of the educational question itself.

A problem arising from a learner's practice may be taken up in ways that differ sharply in their political significance. A teacher might draw on a community's experience with water distribution solely to illustrate a preselected mathematical concept. The same activity might also become an occasion to examine uneven access to water, labor involved in maintaining infrastructure, authority over measurements, and the institutions through which disputes are heard. In the second possibility, the content of inquiry can be changed through the participants' articulation of their situation. The student's initial explanation remains available for substantive criticism and correction. It means that the selection and framing of the problem are themselves open to examination. Freirean dialogue thus provides a reason to ask who can determine the educational agenda, whose interpretations become consequential, and how learning relates to capacities for collective intervention.

The term *generative* already has an important history in Freire's educational vocabulary. His treatment of generative themes concerns the investigation of meanings and contradictions that emerge within participants' historical circumstances [24]. Freire's account is a substantive antecedent: thematic investigation is dialogical, and the teacher returns participants' articulated situation as a problem for collective inquiry (chapter 3, especially pp. 96–97 and 109 in the 30th-anniversary edition) [24]. The proposed concept of invitation focuses more narrowly on the identifiable conditions of a particular offering, its uptake or refusal, and the subsequent access to records and opportunities of inquiry. Those distinctions may supplement Freire's analysis in specific institutional comparisons; their incremental usefulness requires examination. Freire supplies a critical challenge to that proposal: an offering that leaves the institution's selection of relevant problems effectively beyond contestation may remain politically restrictive despite eliciting substantial individual activity.

Freire's approach raises a difficulty concerning the meaning of dialogue under unequal institutional conditions. A teacher may invite discussion while retaining unilateral power over examination, disciplinary sanctions, access to tools, or publication of students' work. The learner's verbal participation may be extensive while the consequences of dissent remain costly. A defensible account of invitation therefore needs attention to practical authority: the possibility of refusing an activity, questioning its premises, challenging the teacher's interpretation, and participating in decisions about the uses of resulting knowledge. Some classroom restrictions may be justified by safety, curricular obligations, or standards of inquiry. The relevant normative question is whether their purposes, scope, and methods remain answerable to those whose activity they govern. An account of dialogue that overlooks these conditions risks confusing inclusion in discussion with a substantive share in shaping its terms.

Rancière's *The Ignorant Schoolmaster* poses a more radical challenge to the educational authority of explanation. Through his reconstruction of Joseph Jacotot's pedagogical experiment, Rancière develops intellectual emancipation around a presupposition of the equality of intelligence and questions practices that reproduce a hierarchy between the mind that explains and the mind presumed to require explanation [45]. This position bears on the assumed starting point of teaching. An educator may know a subject in greater detail, have access to instruments, or be charged with assessing work. These differences can be real and consequential. Rancière's challenge concerns the inference from differences of knowledge or institutional position to a ranking of intellectual worth and the learner's capacity to investigate.

Intellectual equality has a methodological and emancipatory role in Rancière's argument: the student's activity tests a presupposed capacity to investigate, apart from empirical rankings of attainment. In the opening chapter, Rancière distinguishes the teacher's direction of the learner's will from the learner's exercise of intelligence (especially pp. 12–14) [45]. An educator can require sustained attention and careful examination of a learner's work while presupposing the learner's capacity for intellectual activity. This distinction makes the emancipatory significance of an explanation depend on how learners are positioned to exercise their own intelligence. Explanation may open a conceptual path; it may also consolidate a relation in which the learner repeatedly defers to the expert's authority to determine what understanding is possible. Which relation develops requires attention to how explanations are embedded within wider educational practices.

Rancière also brings a distinct difficulty to the proposal of teaching through another's generative language. If the teacher claims to discover, classify, and adapt perfectly to the learner's intellectual

organization, the claim itself may reinforce the teacher's privileged position as interpreter of the learner's capacity. The learner can then appear as a person whose possibility of independent inquiry depends on the educator's prior diagnosis. An emancipatory approach begins from learners' capacity to investigate and produce intelligible relations through efforts that may develop beyond a teacher's initial expectations. The educator may provide a common object, insist upon careful attention, and request an account of the learner's work. The learner's activity can supply evidence for further dialogue while retaining a significance beyond the teacher's explanatory scheme.

Rancière treats intellectual equality as an emancipatory presupposition, while Vygotsky investigates developmental possibilities through mediated activity. The two approaches occupy different argumentative levels and place different pressure on the authority of teaching. Vygotsky's developmental analysis examines the changing relation between capabilities expressed through cooperation and those available in independent activity. Rancière questions the hierarchy that can be instituted when differences in competence become a rationale for intellectual subordination. A teacher who reports that a learner currently completes a task through assistance may be making a warranted empirical observation. The same observation may become objectionable when it is used to assign an inferior intellectual standing or to foreclose the learner's capacity to question. These distinctions address different aspects of pedagogical practice and retain their distinct philosophical commitments.

Similarly, Dewey and Freire place different weights on the sources of a problem's educational importance. For Dewey, the organization of experience, continuity, interaction, and reflective testing are central to assessing an educative activity. Freire directs stronger attention to the historical and political framing of problems, the relations among participants, and the consequences of critical action. An activity can foster careful experimentation while reproducing a severely restricted distribution of authority over what counts as a problem. An activity may also support political articulation while leaving further evidential work necessary to explain its material subject. A philosophical account of teaching can assess these achievements through distinct epistemic and political criteria. The criteria for disciplined inquiry and the criteria for legitimate participation can support one another while remaining distinguishable.

The comparison also limits the appeal to an undifferentiated ideal of autonomy. Within a Deweyan inquiry, autonomy may involve the capacity to pursue and test meaningful problems across changing situations. Within a Vygotskian description, it may involve changed possibilities of acting with or without particular forms of assistance. For Freire, it is inseparable from critical participation in the transformation of historically constituted relations of power. For Rancière, intellectual emancipation concerns the relation through which equality is presupposed and exercised. These formulations can illuminate the same educational encounter, while their criteria of success differ. An improved examination result provides evidence of performance on that assessment; durable inquiry capacity, political emancipation, and changed relations of recognition call for further kinds of evidence.

A constructed case illustrates the practical implications of these differences. Imagine a learner with substantial experience caring for a community garden. The learner is familiar with changes in soil texture, drainage after rainfall, and local planting practices, while having limited experience with classroom statistical models. An educator proposes comparing a set of moisture measurements with the learner's observations and invites the learner to investigate an inconsistency between the numerical pattern and a familiar garden plot. The learner may respond by proposing a new measurement location, contesting the assumed equivalence of two soil conditions, questioning the source of the data, or declining to present community observations without permission. These responses disclose different forms of learner participation whose emergence depends on the evolving encounter.

A Deweyan interpretation would ask how the situation organizes experience and whether observation, conjecture, testing, and later inquiry become more fruitful. An activity in which the learner obtains a correct graph after following detailed instructions may be useful, yet its educational value also depends on how the learner subsequently investigates relevant problems. The educator's choice of measuring instruments, the design of the task, and opportunities to examine surprising consequences form part of the inquiry. Changes in subsequent habits of investigation would be relevant to an assessment informed by continuity and interaction [17].

A Vygotskian interpretation would examine the collaboration through which the learner interprets a distribution, operates an unfamiliar measurement tool, and eventually initiates an analysis under altered conditions. Its evidence would include the nature of guidance, the learner's participation in mediated activity, and later demonstrations of capacity under meaningfully different arrangements. The shift from assisted task completion to independent organization of inquiry would be a developmental question. The initial difficulty with statistical notation would offer limited information about the learner's practical intelligence or capacity to generate researchable questions [62].

A Freirean interpretation would ask who selected the measurements, whose knowledge about the garden was recognized, and whether the problem includes the material and institutional circumstances of its production. If the garden community faces unequal access to water or lacks control over data collected from its work, these conditions could become legitimate subjects of the inquiry. Critical discussion might generate further questions about responsibility, ownership, or community decision-making. Whether the encounter contributes to emancipatory praxis would remain a separate question requiring investigation of the participants' actual power and subsequent activity [24].

A Rancièrian interpretation would attend to the educational relation established when the learner confronts the unfamiliar statistical representation. The teacher could demand close investigation of the data and of the learner's own account while presupposing the learner's intellectual capacity to search, compare, and make sense. Independent interpretation provides relevant evidence of capacity, while emancipation also concerns relations of intellectual authority and recognition. It concerns how intellectual activity is authorized and whether the learner is positioned as an investigator capable of exercising intelligence [45]. The case thus yields four distinct questions: the quality of educative experience, the mediation of development, the politics of problem formation, and the practice of intellectual equality.

The example also reveals difficulties that each perspective leaves open. Soil conditions may be materially different from those assumed in the classroom model; the measurement instrument may be unreliable; and the learner's familiarity with the garden may support some judgments while leaving others mistaken. A responsible educator has reason to explain a technical error, provide a safer method, or indicate when evidence fails to sustain a claim. An invitation to pursue the learner's question preserves standards for assessing answers and the responsibilities of seeking permission for circulating community knowledge. The possibility of inquiry depends on both critical standards for claims and legitimate arrangements for participating in the production and use of those claims.

A comparative framework can preserve the four approaches' distinct philosophical commitments while clarifying their relevance to the same educational encounter. Three distinctions are especially important. The *epistemic* distinction concerns the difference between a learner's opportunity to formulate an answer and the warrant supporting that answer. The *developmental* distinction concerns the difference between an accomplishment during one encounter and a more persistent reorganization of resources for inquiry. The *political-normative* distinction concerns the difference between participation permitted by an institution and authority to challenge, redirect, or govern the terms of that participation. Each distinction can be examined with the others in view; none can serve as a sufficient substitute for the rest.

The concept of generative invitation can be positioned within these distinctions as a provisional analytical object. An educator makes an offering available through some configuration of signs, practices, artifacts, and relations. The learner interprets it through a historically situated, partially accessible configuration of resources; the encounter may yield an answer, a rejected proposal, a changed research question, or a transformed practice. The term *invitation* emphasizes that interpretation and subsequent development remain open to the recipient's activity. Its philosophical significance depends on specifying the available options, asymmetries of authority, and consequences for further action. Choosing the order of predetermined tasks affords a narrower scope of agency than participating in the revision of research questions, evidential standards, or authorized uses of findings.

This proposed account inherits several unresolved tensions. Teachers have responsibilities for accuracy, access, safety, and justified evaluation; the exercise of those responsibilities may require explanation and direction. Learners have claims to intellectual standing, meaningful participation, and protection from coercive categorization. Some forms of expertise are needed to recognize a faulty model or

an inaccessible instrument; some uses of expertise can undermine the learner's confidence or opportunity to investigate independently. Institutional curricula can secure broad access to shared disciplinary knowledge while also privileging particular histories of participation. These tensions call for judgments grounded in the concrete educational relation. The comparison offers criteria for situated interpretation and evaluation of educational practices.

A further limit concerns the object described as the learner's generative language. Its historical, social, and material dimensions help interpret the conditions in which educational offerings are encountered; the meaning of particular responses remains open to further inquiry. Pedagogical understanding develops through further encounter, correction by learners, and independent assessment of relevant knowledge claims. An institution's classification of a learner's language may obscure internal variation or produce the very dependency it seeks to alleviate. The equality presupposed in emancipatory pedagogy, the particularity of developmental mediation, the continuity of experience, and the politics of dialogue therefore operate as checks upon overly confident descriptions of another's capacities.

The comparison identifies four distinct considerations for pedagogical judgment. Dewey foregrounds the continuity and quality of experience; Vygotsky examines the developmental possibilities of mediation; Freire situates educational questions within relations of dialogue and power; and Rancière challenges explanations that turn expertise into intellectual hierarchy. Together, their differences clarify the dimensions along which a pedagogical offering can be assessed: its experiential significance, developmental accessibility, political formation, and distribution of interpretive authority. Generative invitation may organize these considerations around the learner's consequential uptake of an offering. The next inquiry concerns how a teacher can recognize the historically situated resources through which such uptake becomes possible.

4 Historically Situated Capacities and the Encounter with a Teacher

Pedagogical encounters bring together a learner's developed capacities, the opportunities available for exercising them, and a teacher's interpretation of both. This section distinguishes these three aspects, tracing how histories of participation influence present educational possibilities and how institutional classifications shape their recognition. Sociocultural research, studies of households and communities, accounts of educational reproduction, and capability-based reasoning inform the comparison. The resulting account treats pedagogical recognition as an ongoing practice of interpretation and correction, guided by disciplinary evidence and responsive to the learner's participation.

The expression *historically situated capacity* refers here to an ability to undertake some activity under identifiable enabling conditions, whose development can be traced, at least in part, through relations with other people, objects, institutions, and practices. The relevant activity may involve recognizing a pattern, operating a tool, arguing for a claim, understanding a warning, negotiating a collective decision, or devising a new question. The history of a capacity concerns how opportunities for its exercise were formed and transformed; its situatedness concerns the conditions under which the capacity can presently become effective. These aspects are interdependent, but analytically distinguishable. A learner's accomplished use of a measuring tool may reflect extensive experience in one setting while remaining difficult to demonstrate in another setting with unfamiliar conventions of explanation. Likewise, an apparent absence of performance may result from inaccessible equipment, unfamiliar assessment language, or restrictions on participation, even when relevant practical competences have been developed elsewhere.

Calling a capacity historically situated is compatible with examining individual development and distinguishing actual achievements. It directs attention to the conditions under which individual activity has been made possible and intelligible. Rogoff's account of cultural development describes participation in communal practices, changing responsibilities, and intergenerational relations as integral to developmental inquiry [47]. Lave and Wenger's analysis of legitimate peripheral participation further clarifies that access to activities, artifacts, and recognized positions within a community may shape the trajectory through which competence develops [35]. These accounts support examining a learner's performance together with the task and the conditions under which participation occurred. A learner's deliberation re-

mains significant within an account of competence that also takes social histories and relations seriously.

A useful distinction arises among *developed resources*, *available opportunities*, and *manifest performance*. Developed resources include practical familiarity, habits of comparison, bodily coordination, concepts, strategies, and relations of assistance formed through previous activity. Available opportunities concern the accessible tasks, instruments, time, permissions, collaborators, and institutional spaces within which such resources might be exercised. Manifest performance concerns what occurs in a particular encounter, under its particular demands and constraints. These terms serve as related observational and philosophical distinctions. A resource becomes intelligible through occasions of its use; an opportunity can require newly developed abilities to become actionable; and a performance can itself transform later resources. Treating these dimensions as equivalent can lead to misleading interpretations of educational performance. A high assessment score may conceal dependence on a narrow task format, while a poor score may conceal effective forms of inquiry that the assessment does not permit the learner to demonstrate.

Sen's account of capabilities offers a related normative comparison, especially in distinguishing the possession of means from substantive possibilities for valued activity [55]. An educational setting may provide the same printed exercise to several learners while supplying markedly different opportunities to understand, question, and complete it. A shared resource is therefore an insufficient description of equal access. The term *capacity* in this paper, however, retains a narrower pedagogical role: it concerns historically acquired and potentially developing resources for particular forms of inquiry. Sen's capability approach concerns evaluative space and freedom among possible functionings, with implications extending well beyond education. The comparison directs attention to the conditions under which an educational opportunity can actually be exercised, while the capability approach and the present GR vocabulary retain different theoretical purposes.

Educational histories themselves are heterogeneous. Familiarity with a scientific problem can arise through household maintenance, paid or unpaid work, religious and artistic practice, participation in online communities, care activities, previous schooling, or independent experimentation. These sites differ in their norms of evidence and in the authority they confer on participants. A child who has helped maintain a household electrical system may know when a connection behaves unexpectedly while lacking permission, the mathematical language, or the safe equipment necessary for a formal investigation. Another learner may be fluent with circuit diagrams yet have little experience interpreting an actual damaged component. The difference concerns configurations of acquired resources and opportunities, rather than a general ranking of intelligence. The task of education may include making previously disconnected resources available for new forms of inquiry, while acknowledging that some earlier ways of acting require substantial revision in light of disciplinary evidence or safety requirements.

Research on *funds of knowledge* offers a significant precedent for taking these histories seriously. Moll and colleagues investigate how teachers might learn from the knowledge and practices associated with households and local communities [39]. The later edited collection expands this programme through accounts of community research and its implications for educational relationships [26]. Its relevance here concerns a change in the object of pedagogical inquiry: a teacher may seek concrete accounts of activity and expertise where institutional descriptions have concentrated on presumed lack. Such attention can reveal available forms of reasoning and participation that otherwise remain unnoticed. These sources also clarify the importance of participant authority and the situated meaning of cultural content. Household practices have their own histories, internal variation, ethical constraints, and unequal distributions of labor and authority. Treating them as a stock of illustrative examples for school lessons may reproduce the very extraction and misrecognition that a relational educational approach seeks to examine.

A learner's history therefore has to be approached through particular, revisable descriptions. Nationality, ethnicity, first language, social class, disability classification, occupation, or an administrative achievement category may be relevant to an educational situation, yet none provides a complete account of the learner's acquired capacities or current aims. Each category can combine differences in experience, access, interpretation, and relationship to institutions. Some learners may identify strongly with an attributed practice; others may reject the expectation that they should represent it. A culturally responsive

lesson framed around a presumed shared community identity may place an additional representational burden on learners whose experiences differ. Recognition can begin by investigating particular persons and practices through their own responses, including responses that challenge familiar categories.

The teacher enters the encounter with a history of their own. Disciplinary preparation, professional expectations, assessment norms, preferred modes of explanation, and prior experiences with students help determine which signs of competence are immediately legible. A mathematics instructor may recognize a familiar formal proof more readily than an effective practical estimate; a laboratory instructor may value written procedures while overlooking a learner's attention to changes in materials. Such habits can serve legitimate functions. Shared notation, reproducible procedures, and explicit arguments enable examination across contexts and allow other participants to challenge a result. Yet the criteria by which competence becomes visible may also reproduce historically privileged cultural forms. Bourdieu and Passeron's account of educational reproduction offers a structural warning: institutions may confer the appearance of neutral authority on selections of cultural knowledge and modes of pedagogical communication that are entangled with relations of power [10]. The present argument uses that warning as a question about institutional recognition, while leaving open the empirical extent and mechanisms of reproduction within any particular school.

The possibility of misrecognition has at least three forms. *Deficit misrecognition* occurs when an educator treats difficulty with an institutional task as evidence of a general absence of relevant competence. *Romantic misrecognition* occurs when a teacher attributes competence, authenticity, or epistemic authority to the learner on the basis of an idealized conception of the learner's background. *Instrumental misrecognition* occurs when a genuine ability is recognized chiefly as a means of securing predetermined institutional outcomes, with limited regard for the learner's aims or authority over the use of the ability. These are provisional analytical categories. Their usefulness lies in separating different sources of error and possible harm. A student can suffer from being underestimated, from being expected to speak for a community, and from having privately learned knowledge incorporated into a public teaching product without meaningful choice.

The educational significance of these errors extends beyond politeness or interpersonal affirmation. Fricker's account of epistemic injustice helps identify how a speaker's standing as a knower may be damaged through socially conditioned failures of credibility or interpretive access [25]. The relation between that general philosophical analysis and an educational encounter requires care. Educational responsibility includes critical evaluation of reasons and the correction of claims whose evidential support is inadequate; the manner and distribution of this authority remain relevant to justice. Injustice becomes a relevant concern when a learner's contribution is discounted through prejudicial assumptions, or when available interpretive practices systematically obstruct the learner's ability to render an experience intelligible. A rigorous appraisal therefore asks both whether the learner's claim is warranted and whether the procedures for hearing and testing that claim accord the learner appropriate standing.

Recognition is also vulnerable to mistakes of scale. An educator may observe a competent performance, infer an enduring personal disposition, and subsequently assign tasks on the strength of that inference. A different institution might interpret the same performance through a different evaluative vocabulary. The specific inference from a situated act to a stable capacity has to be tested across relevant conditions. A successful explanation and a hesitant public response each provide task-specific evidence; broader claims about reasoning capacity require observations across suitable conditions. Conversely, recurring successes across altered situations may support stronger conclusions than a single favorable demonstration. These principles guide situated interpretation of educational evidence. Their application requires attention to the accessibility, comparability, and social meaning of the situations in which performance is observed.

A teacher may address uncertainty through forms of inquiry that treat the learner as a participant in the interpretation of their own activity. The educator can invite accounts of how a task is approached, observe materially situated work, vary tools or modes of communication, examine errors together, and ask which descriptions the learner finds accurate. Responses can correct the teacher's assumptions and can reveal a relation between a familiar practice and an unfamiliar concept. These methods yield partial,

situated evidence about another person's capacities and interpretations. Self-report, teacher observation, institutional records, and task performance provide different and sometimes conflicting evidence. Their interpretation should remain open to revision, especially when linguistic asymmetries, status relations, or evaluative pressure may discourage disagreement. The objective is an accountable, revisable working understanding of the educational encounter.

Pedagogical recognition further requires attention to who is entitled to disclose a history. Knowledge developed in families, workplaces, and communities can involve obligations to other people. A learner may have authority to discuss a procedure while lacking authority to share names, records, locations, or collectively governed details. Connecting classroom inquiry to community practice involves separately considering permission to hear an example and permission to collect, publish, or reuse its underlying material. Educational benefit can motivate a discussion of participation while consent, attribution, and community responsibilities govern the use of shared information. This distinction becomes particularly important when teachers or institutions retain control over records, authorship, assessment, and circulation of resulting work. The more extensive political economy of these relations belongs to the subsequent discussion of knowledge return and institutional power.

A constructed case illustrates the practical reach of these distinctions. Consider an adolescent learner who has helped coordinate communications during seasonal flooding in a coastal community. The learner knows how particular paths become impassable, how neighbors interpret changing water levels, and why a locally trusted signal may arrive earlier than an official message. At school, the learner encounters a map-based exercise in which rainfall intensity is related to a predicted travel time along selected routes. The teacher initially interprets the learner's hesitant use of a geographic information system as a general lack of geographical competence. Yet the learner can identify a road segment whose apparent elevation does not correspond to the conditions encountered during a recent storm. The constructed example illustrates how differing sources of geographical knowledge might be investigated within an educational encounter.

Several epistemic possibilities are present in the case. The learner may be correct about the road because local observation reveals a limitation in the map's resolution. Alternatively, it may reflect an earlier drainage condition, a narrow context of use, or an inaccurate recollection. The learner may possess useful practical distinctions while having limited familiarity with contour intervals or spatial interpolation. The map may include different temporal reference points from those assumed in the classroom. The teacher's appropriate response depends on the particulars of the discrepancy. The learner's historically formed insight supplies a possible route into inquiry, while the empirical warrant for a revised map requires appropriate measurement, access to records, and further testing. Respect for the learner's contribution and accountability to geographical evidence can therefore operate together.

The institutional arrangements surrounding the exercise shape what the learner can do with the discrepancy. If the teacher's assessment rewards only the replication of a supplied model, the learner may have a practical reason to suppress the observation. If the class can inspect metadata, compare available records, and explain uncertainty, the learner may contribute to evaluating the model. If the learner has no access to a usable interface, an alternative format may be necessary for participation. If the proposed investigation involves identifiable neighbors or emergency communications, consent and appropriate data handling are relevant conditions. Each variation alters the learner's opportunity to demonstrate and further develop a capacity. The example thus separates the recognition of an observation, the conditions for investigating it, and the authority to determine how findings are subsequently used.

The case also reveals the limits of a familiar instructional impulse: asking a learner to connect a lesson to their personal life. Such an invitation can support learning when the learner wishes to establish the connection and possesses meaningful authority over its content. It can also introduce involuntary disclosure, stigma, or an expectation to authenticate a cultural identity before peers. A learner who has experienced flooding may prefer to discuss an abstract model, examine another region, or remain silent about household experiences. A decision to withhold personal examples can coexist with substantial relevant knowledge and a continuing willingness to learn. An educational opportunity can be available without being compulsory; the legitimacy of disclosure depends on the relation in which it is requested.

The encounter involves several kinds of teacher responsibility. There is an *epistemic responsibility* to distinguish reliable observation from conjecture, to explain the domain of a model, and to correct errors by reasons that others can examine. There is a *pedagogical responsibility* to make relevant forms of participation and explanation accessible while maintaining a view of the learner's developing competence that can be corrected. There is a *relational responsibility* to exercise institutional authority with regard for the learner's agency, vulnerability, and legitimate limits on disclosure. There may also be a *public responsibility* where the inquiry affects others through publication, safety decisions, or circulation of community knowledge. These responsibilities are related, although practical tensions can arise. A teacher may need to prohibit unsafe experimentation while providing other opportunities for independent analysis; a learner may have strong reasons for withholding data while retaining a legitimate claim to participate in the conceptual investigation.

Teacher expertise remains important under these conditions. Knowledge of disciplinary methods can help determine whether a learner's observation is relevant, which tests are appropriate, and where a proposed explanation exceeds available evidence. Expertise can also help identify constraints that the learner has had little opportunity to encounter. However, the authority of a teacher to judge a method's reliability differs from an unrestricted authority to define the learner's purposes or to possess the learner's knowledge. Freire's analysis of dialogue makes the relation between knowledge and political participation central to educational philosophy [24]; Rancière's examination of intellectual equality challenges the assumption that one participant's disciplinary knowledge entails a higher rank of intelligence [45]. The present paper retains their differences. Dialogical transformation of social relations, the presupposition of equality, and accountable disciplinary expertise address distinct responsibilities within the inquiry.

The question of developmental change likewise requires more than recognition at the initial encounter. Vygotsky's treatment of learning and development suggests examining what becomes possible through mediated activity and what later becomes possible under altered conditions [62]. A teacher might learn to appreciate the flood-communication learner's existing competence without enabling access to new analytical resources. Alternatively, the learner may acquire the ability to work with geospatial evidence while continuing to rely on the teacher's explanation for each disputed result. A stronger educational transformation might involve the learner initiating a related problem, identifying the limits of several representations, deciding when assistance is needed, and explaining a finding to an unfamiliar audience. Even these observations would require attention to task differences, ongoing support, and the longer history of the learner's participation. The philosophical point is that respectful recognition, immediate success, and durable development remain distinct educational outcomes.

The same encounter may also change the teacher. If the teacher discovers that an institutional map fails to represent a relevant local condition, the teacher's disciplinary understanding and future instructional design may need revision. The recognition of another participant's competence can produce reciprocal inquiry, including changes in what the teacher regards as a significant educational problem. Dewey's emphasis on the continuity and interaction of experience is pertinent to this possibility [17]. Yet reciprocity should be described through identifiable changes in practice or understanding. A teacher's declaration that a learner has offered a valuable perspective provides limited evidence of institutional change if the assessment criteria, allocation of authority, and permitted forms of participation remain unaffected.

The possibility of reciprocity is particularly consequential across differences in age, linguistic background, institutional standing, and practical experience. An adult can be a novice in a child's domain of expertise; a teacher can be unfamiliar with the tools and conditions of a student's workplace; a formally advanced learner can lack resources that another learner uses fluently. Such asymmetries are multidimensional and may change with the task. A pedagogical encounter can involve reciprocal transformations of understanding alongside asymmetries of expertise and institutional responsibility. Such reciprocal learning takes place amid continuing differences in duty, vulnerability, and legally defined responsibility. Recognition becomes more adequate when it is specific to the relevant activity and transparent about the authority that each participant can exercise.

These observations suggest a provisional criterion for pedagogical recognition. A teacher's interpre-

tation of the learner's resources is more responsible insofar as it specifies the activity under consideration, investigates the conditions of observed performance, invites correction where appropriate, respects the terms of disclosure, and remains revisable in light of further participation. This procedural and interpretive criterion can guide the assessment of recognition practices; claims about its effects on learning require empirical investigation. It asks teachers to work with relevant and revisable evidence about learners' participation histories. Indeed, the possibility that some relevant histories will remain unknown, private, or difficult to express is among the reasons for maintaining revisable judgments and multiple paths into inquiry.

In the present GR vocabulary, the encounter links historically evolving repertoires whose organization is only partly accessible to the participants. A teacher's pedagogical offering is shaped by the teacher's history and institutional position; its significance to a learner depends on the learner's practices and on the available conditions of engagement. This representation may illuminate why an apparently identical task can become a different educational opportunity across participants and contexts. As a heuristic account, it describes partially accessible histories and capacities whose correspondences are investigated through the encounter. Its explanatory contribution will depend on whether it clarifies specific processes and practical judgments more effectively than established frameworks of mediated participation, recognition, and situated learning.

Responsible pedagogical recognition therefore connects three inquiries: how relevant resources developed, which present conditions permit their exercise, and what participants actually accomplish in the encounter. These inquiries reveal different possibilities for misrecognition and different occasions for revising an educator's judgment. A teacher's expertise helps assess the quality of evidence, while the learner's participation informs interpretations of capacity and meaning. This account prepares a more specific analysis of pedagogical offerings: which problems, representations, and material opportunities allow a learner to exercise and extend those capacities in consequential inquiry?

5 Problems, Forms, and Generative Invitations in Teaching

A pedagogical offering can take the form of a question, object, representation, method, or opportunity to participate in a practice. Its educational significance develops through the learner's possibilities for engaging with and transforming what is offered. This section defines *generative invitation* as a provisional account of that relation. Drawing on pragmatist inquiry, problem-posing education, and research on disciplinary engagement, the discussion distinguishes an available offering from substantive opportunities to investigate, contest, and redirect it. Attention to the scope of learner decisions and to disciplinary responsibilities prepares the subsequent analysis of translation across pedagogical and learner practices.

Educational problems take several forms. A problem can designate an exercise whose answer and procedure are already known to the teacher; a discrepancy within a learner's practical experience; a contested question within a disciplinary community; or a difficulty arising from the material conditions of collective life. These cases may all produce worthwhile learning, while organizing different relations to uncertainty. An exercise can cultivate reliable technique and demonstrate whether a procedure has been understood. An unresolved discrepancy may call for choosing observations, reformulating assumptions, and deciding what would constitute an adequate explanation. An institutionally assigned problem may also contain consequential decisions about whose concerns are represented and which solutions can be considered. The pedagogical question is thus broader than the presence of a question mark in the assignment. It concerns what aspects of the situation remain available for investigation and who may legitimately participate in determining them.

Dewey's account of thinking in education gives a strong precedent for locating problems within the learner's activity. His discussion of reflective experience links the development of thought to meaningful difficulties, available material for inquiry, and tests through consequences; chapter 12 explicitly asks whether the problem is genuinely the pupil's own [16]. This perspective highlights a difference between a task that elicits the recall of a prescribed answer and a situation in which the learner recognizes why something requires explanation. Recognition may itself require assistance. A learner can experience an

unexpected measurement as a mere failure to follow instructions, or as evidence that a working assumption deserves reconsideration. Educational design can influence which interpretation becomes available, while actual uptake depends on the developing encounter. An invitation, on the account developed here, concerns the possibility that a learner comes to treat an offered situation as an object of inquiry under conditions that leave meaningful decisions open.

The lineage of problem-posing education presents another, partly independent question. Freire's treatment of dialogue and generative themes situates educational problems within the histories and social circumstances of participants [24]. The identification of a community-related theme calls for participatory interpretation of its significance and of the authority to develop it into a curricular question. The participants' ability to articulate, correct, and transform the proposed problem is itself part of the educational relation. This argument has a political orientation that extends beyond the present section's narrower conceptual task. Nevertheless, it establishes a crucial constraint: a question framed in the vocabulary of a learner's practices may still be governed entirely by an outsider's purposes. Familiarity of content and authority over problem formation are distinguishable characteristics of an educational offering.

For the present investigation, *generative invitation* names a provisional type of encounter in which another participant's potential activity has a constitutive role in what follows. Definition 5.1 states the proposed analytical conditions for investigating these encounters; empirical assessment of their educational effects remains a further task.

Definition 5.1 (Pedagogical generative invitation). A *pedagogical generative invitation* is a situated educational offering whose intelligible entry points, actionable resources, and revisable scope provide a learner with a substantive opportunity to investigate, interpret, elaborate, contest, or redirect a problem or form through the learner's developing practices. The description presupposes attention to the actual conditions of participation, the consequences of declining or modifying the offering, and the continuing legitimacy of relevant standards of evidence and care.

The status of an invitation should be assessed separately from its uptake and its subsequent effects. Evidence concerning the *offering* includes the available resources, accessible entry points, permitted decisions, and foreseeable consequences of contesting or declining participation. Evidence concerning *uptake* concerns what a learner actually understands, selects, questions, or changes. Evidence concerning *development* concerns warranted understanding and capacities shown in later activity. An invitation may be offered under favorable conditions and receive little uptake; an initially constrained lesson may nevertheless contribute to durable independent inquiry. Separating these observations allows the proposal to face unfavorable cases without redefining every disappointing result as the absence of an invitation. The existence of an invitation remains an interpretive judgment about situated opportunity, to be checked against participants' accounts and observable institutional conditions.

Definition 5.1 identifies four conditions: an intelligible entry point, usable resources, a revisable scope, and a substantive opportunity to affect inquiry. These conditions concern what learners can do with an offering. Selecting a diagram's color affords presentational choice; selecting evidence, questioning a model, or reframing a problem affords epistemically consequential discretion. Whether that discretion is available depends on the task, support, assessment rules, and the learner's practical circumstances.

The scope of such discretion is usefully described as an offering's *operative openness*: the set of decisions through which a learner can affect the question, evidential procedure, interpretation, or subsequent use of an educational result. Operative openness is situated. A teacher may offer several nominal topics while imposing one method and one interpretation; a tightly specified task may still leave room for consequential criticism of its assumptions. It also depends on the practical consequences of disagreement. Learners may exercise legitimate judgment through a proposed modification, a request for further support, or a refusal to disclose personal experience while continuing the disciplinary activity through other materials. These possibilities should be assessed against actual time, accessible resources, grading arrangements, and institutional authority. The distinction clarifies why the visible number of options alone is an uncertain measure of an invitation.

An offered *form* may be a diagram, notation, story, classification, experiment, algorithm, map, or argumentative convention. Forms make some comparisons and disagreements expressible while foregrounding particular distinctions. Their educational use ranges from learning a convention to adapting it for a new question. Generative invitation is especially concerned with the latter possibility: the learner can participate in deciding what a representation should accomplish.

The relation between learner authority and disciplinary accountability is addressed directly in Engle and Conant's analysis of productive disciplinary engagement. Their study proposes designing learning environments around problematizing subject matter, granting learners authority to address problems, maintaining accountability to others and disciplinary norms, and providing relevant resources [21]. Their empirical analysis concerns an extended species-classification controversy among fifth-grade students in a Fostering Communities of Learners classroom, providing a concrete comparator for the present proposal. They place the responsibility to reason and the availability of intellectual resources alongside student authority. The proposed vocabulary of generative invitation is useful insofar as it clarifies entry points, transformations of questions, and changes in the relation between learner resources and educational forms. Research on expansive framing also connects learners' present participation with future contexts and opportunities to contribute beyond an instructional episode [22]. Together, these precedents establish a demanding basis for evaluating what the proposed staged description contributes to educational interpretation and practice.

Problems differ in *provenance*: they may arise from learner activity, disciplinary controversy, teacher interpretation, or external obligations. Their sources shape whose purposes enter the inquiry and who can contest its framing. A learner's original concern may need refinement through evidence and disciplinary methods; a teacher's proposal may need adjustment to respect the learner's or community's purposes. The pedagogical task is to make this negotiation intelligible and consequential.

An invitation can create productive *tension* between familiar practices and unfamiliar forms. Conflicting predictions, categories, or readings may disclose a question that learners can investigate. Its educational value depends on accessible resources, meaningful support, transparent assessment, and room for warranted disagreement.

Invitation and *instruction* organize different relations among pedagogical guidance, learner agency, and specified procedures. Instruction may be warranted when safe equipment use requires a prescribed procedure, when a shared convention must be learned before collective activity becomes possible, or when an educator needs to correct a demonstrable error. The distinctive feature of an instruction is the teacher's authoritative specification of a required action or answer within a particular domain. A generative invitation, by contrast, makes at least some consequential development of the inquiry dependent on the recipient's interpretation and decisions. Many serious educational encounters combine these modes. A learner may first receive a precise explanation of how an instrument is calibrated, then investigate which measurements should be taken and whether the results support the assumed model. The transition between modes is itself a matter for practical judgment and, where possible, explicit communication.

The expression *invitation* may suggest a wholly voluntary activity, yet educational participation often occurs under attendance requirements, curricular obligations, or conditions of unequal power. The analysis therefore considers the actual choices and consequences available within these institutional circumstances. A teacher might legitimately require attendance at a scientific laboratory while allowing meaningful discretion over the research question and design within specified safety limits. In another setting, a learner may be required to engage with a historical text while retaining the capacity to challenge the teacher's interpretation. The local freedom to redirect inquiry can be genuine even when participation in the broader course is compulsory, provided the freedom has consequential scope and its limits are intelligible. Conversely, a task described as optional can offer little practical freedom when refusal entails stigma, loss of access, or an unfair assessment penalty.

The *possibility of refusal* is one diagnostic of participation, including negotiated or redirected involvement. A learner may reject public disclosure of personal experience while undertaking an equivalent investigation through other evidence. The educational significance lies in which consequential choices remain available and whether curricular obligations and protective boundaries are explained.

This approach is compatible with the educational value of teacher initiative. Biesta's discussion of educational risk emphasizes the openness of learners' responses and the responsibilities that arise from engaging persons whose futures remain partly indeterminate [8]. For the present inquiry, this highlights how a pedagogical offering can redirect educational activity through the learner's participation. A teacher's responsibility persists through such uncertainty. The teacher remains answerable for the accuracy of technical claims, the safety of procedures, equitable access to resources, and the ethical conditions of participation. Unexpected learner responses and disciplinary expertise each call for situated assessment of evidence, interpretation, and normative responsibility. The relation is educationally meaningful when authority can be exercised, explained, and revised according to its domain.

A constructed case may clarify these distinctions. Consider a class investigating the coordination of two public transport routes serving a neighborhood. Some learners are familiar with the practical uncertainty of service intervals through commuting or caregiving; others are more fluent in mathematical tables and numerical patterns. The teacher introduces a simplified schedule in which one route arrives every twelve minutes and another every eighteen minutes, with both departing together at a stated reference time. Under the simplifying assumption of perfectly regular departures, the next coincident arrival can be found through the least common multiple. An instruction-centered version of the lesson might require learners to identify the common multiple and reproduce the procedure. That lesson could appropriately develop an important mathematical technique. Such instruction can provide a clear and worthwhile introduction to calculating periodic coincidence.

In an invitation-oriented version, the educator offers the same schedule and the question of when two routes would coincide, while opening the assumptions and practical interpretation to examination. A learner might derive the least common multiple by listing arrivals; another might propose a visual representation; another might ask whether coincidence at a shared stop has any relevance if the two routes travel in opposite directions. A further learner might distinguish scheduled intervals from actual waiting times and seek evidence about delays. These responses concern different objects: an arithmetic regularity, a representational method, a journey-planning problem, and the reliability of a model. The teacher can preserve the mathematical task's standards while asking learners to specify which question their answer addresses. Mathematical correctness and contextual adequacy become distinct, mutually relevant achievements.

The transit exercise becomes an invitation when learners can challenge a consequential assumption: which arrival matters, what uncertainty the timetable hides, or how accessibility changes the model. Multiple answers alone provide weak evidence of such authority. The teacher remains responsible for distinguishing a mathematically valid calculation from a defensible interpretation of the travel situation.

The same case demonstrates how apparently generous invitations can fail. Suppose the teacher invites varied interpretations yet awards credit exclusively for the original numerical answer and leaves the assessment criteria unexplained. Learners may reasonably infer that alternative formulations are ornamental. Alternatively, the teacher might give equal credit to proposed answers despite contradictory calculations of the specified intervals. Learners then lose access to important criteria for judging mathematical claims. An invitation requires a different organization: the arithmetic assertion is assessed against the explicit model; the model's practical relevance is examined with appropriate external evidence; and contributions that redirect the inquiry receive consideration under announced criteria. The resulting practice may combine clear instruction, independent investigation, and accountable collective discussion.

The encounter's temporality also matters. An invitation may first be offered as an unfamiliar task, later become intelligible through shared exploration, and eventually be transformed by a learner's new question. Its meaning can change during the activity. A premature interpretation of an initially hesitant response as failure may obscure the development of resources that make subsequent participation possible. Conversely, an immediately enthusiastic response may yield little sustained inquiry once the teacher withdraws support. The proposed GR vocabulary can represent this through evolving relations among participant capacities, artifacts, and opportunities, but the representation remains heuristic. The explanatory burden lies in identifying specific transitions that are observable or reconstructable and in

comparing them with existing accounts of participation and mediated learning [62, 35]. A full account of durable knowledge formation requires evidence beyond the encounter and is developed later in this paper.

Teachers must determine which parts of an inquiry are responsibly negotiable. Calibration, safety, and the integrity of evidence may require explicit constraints; choice of questions, comparison sites, or applications may support meaningful initiative. Explaining the allocation of discretion helps learners understand where their decisions can change the activity.

Unequal entry conditions also affect an offering's practical availability. Learners differ in access to time, language, equipment, trust, and prior experience. An invitation therefore requires attention to usable supports and alternative ways of contributing, with standards of evidence adapted only where the educational objective warrants adaptation.

The normative status of a pedagogical invitation also depends on what can happen to the knowledge produced. Learners may generate a new interpretation, dataset, or communal resource through the offered activity. Recognition of a learner's classroom contribution is followed by distinct decisions concerning publication, retention, commercialization, and institutional attribution. Those questions implicate consent, attribution, and the distribution of control; they will be examined in the later discussion of recognition and institutional power. For present purposes, they establish that the boundaries of an invitation may extend beyond the immediate question. A learner should be able to understand, to an appropriate extent, the intended uses of contributions that the educational encounter asks them to make. The opportunity to investigate is connected to the conditions under which inquiry can remain the learner's own activity.

Three provisional criteria emerge from the analysis. First, an invitation has *relational intelligibility*: learners have an accessible way to understand and enter the offered situation, including resources for developing unfamiliar competencies. Second, it has *consequential revisability*: some aspect of the problem, representation, method, or direction remains genuinely responsive to learner judgment. Third, it has *accountable conditions of participation*: disciplinary standards, obligations, foreseeable consequences, and relevant boundaries are accessible for discussion and reasoned application. These criteria organize the proposed inquiry and provide directions for subsequent empirical evaluation. They may come apart: a task can be accessible yet wholly predetermined, open to redirection yet materially inaccessible, or empowering within its immediate scope while governed by obscure rules about evaluation and use. Evaluating a particular educational encounter requires attention to these divergences.

The concept of generative invitation can be evaluated alongside established educational accounts. Dewey's inquiry gives a basis for examining meaningful problems and the testing of ideas; Freire's pedagogy challenges the politics of problem selection and dialogue; Engle and Conant connect student authority with disciplinary accountability and adequate resources; and Biesta draws attention to the irreducible uncertainty of educating subjects of action and responsibility [16, 24, 21, 8]. Generative invitation seeks to describe the local structure through which a pedagogical offering encounters a learner's evolving resources and becomes open to transformation. Its explanatory and practical contribution can be investigated through comparisons of the processes it distinguishes, the judgments it supports, and the educational transformations it helps make intelligible.

Generative invitation joins an intelligible offering to usable resources and consequential possibilities for learner-directed inquiry. This account prepares a distinct question: how can pedagogical and learner practices acquire workable correspondences while retaining differences relevant to judgment? Section 6 examines that translation.

6 Translation Between Pedagogical and Learner Generative Languages

A generative invitation depends partly on connections between the practices through which educators present knowledge and those through which learners make sense of an offering. This section examines such connections as *translation*: the situated construction of usable correspondences across linguistic, representational, material, and practical activities. It distinguishes understanding an expression from

coordinating a task and from establishing an epistemically warranted claim. A limited relational representation and a constructed case clarify how correspondences can enable inquiry while leaving differences that remain significant to the participants. The resulting account provides an interface between the structure of an invitation and the learner’s subsequent knowledge formation.

A *pedagogical generative language* designates the repertoire through which an educator or institution frames problems, evidence, demonstrations, and standards. Learner repertoires may organize similar activities through other signs, routines, purposes, or materials. Their encounter calls for locally usable correspondences between practices.

Shared words or diagrams can conceal different operations. For example, a learner and teacher may both speak of a “pattern” while applying different criteria for what counts as a recurrence or an adequate explanation. Examining the associated tasks and judgments clarifies what has become mutually intelligible.

Language and practice consequently need to be considered together. Lemke’s analysis of scientific classroom discourse connects doing science with learning how scientific meanings are made through talk and other semiotic resources [36]. For the present inquiry, participation in a disciplinary practice also involves using specialized terms to organize explanations, judgments, and actions. Likewise, sociocultural accounts treat tools and artifacts as mediators of activity, and draw attention to shifts in participation and social relations as educationally consequential phenomena [62, 40]. Translation may involve speaking, drawing, manipulating an instrument, reproducing a procedure, contesting an inference, or comparing consequences. Different media can make different aspects of an encounter available to interpretation.

Here *translation* means establishing a workable, revisable correspondence between moves in different repertoires, for specified educational purposes. The correspondence may enable communication, coordinated action, or an examination of evidence; these achievements require separate assessment.

The social study of scientific collaboration supplies one useful comparison. Star and Griesemer describe how heterogeneous participants can cooperate through standardization and boundary objects that remain adaptable to distinct viewpoints while supporting common work [58]. Their historical account concerns museum-related scientific collaboration; its relevance to classroom instruction is therefore comparative and requires attention to educational circumstances. It nevertheless gives an important conceptual alternative to the idea that cooperation requires a complete shared conceptual scheme. An artifact may coordinate activities across communities whose interpretations remain partly different. A field log, specimen record, or jointly annotated map can provide a sufficiently stable point of contact for a particular task while retaining distinct uses for participants. In an educational setting, the analogous question is how the shared object is made available for the learner’s own interpretive and investigative activity.

Educational research on boundary crossing develops this problem more directly. Akkerman and Bakker review boundaries as dialogical phenomena and distinguish possible learning mechanisms of identification, coordination, reflection, and transformation [3]. Their review treats boundary learning broadly, including changes in understanding, identity, practices, and institutions. It locates efforts of translation among the characteristic processes of coordination and describes transformation through confrontation, hybridization, and sustained joint work (Akkerman and Bakker, 2011, pp. 142–152). Accordingly, a proposed pedagogical translation should be assessed in relation to the particular learning mechanism evidenced by the encounter. This manuscript uses that established distinction to specify the evidence appropriate to coordination, reflection, or transformation. A diagram that enables a learner to finish an exercise may mark coordination. A discussion that makes assumptions mutually visible may mark reflection. A revised measurement practice jointly developed by participants would require stronger evidence of transformation. These outcomes should be examined individually.

The proposed formal abstraction is given in Definition 6.1; its limited scope makes the terms of comparison explicit.

Definition 6.1 (Situated pedagogical translation relation). For a specified educational context c , let P_c denote an analytically selected set of relevant moves within an offered pedagogical repertoire and let L_c denote relevant moves within a learner’s situated repertoire. A *pedagogical translation relation* is a context-indexed, potentially partial and many-to-many relation associating moves whose correspondence

participants can articulate and test for a stated purpose. It is represented in Equation 1.

$$\mathcal{T}_c \subseteq P_c \times L_c. \quad (1)$$

Equation 1 offers a limited descriptive representation of locally articulable correspondences. A proposed pair in $\mathcal{T}_c$ warrants further description: participants should identify the move in each repertoire, the purpose for which a correspondence is claimed, and a feasible way to examine what the correspondence preserves or changes. Such evidence may include a jointly corrected diagram, an explanation of a practical procedure, or the consequences of using a representation under altered conditions. A mapping that supports verbal agreement while leaving a relevant practical inference unexamined remains a candidate correspondence. These requirements give the abstraction a more determinate interpretive role while allowing its membership to remain context-dependent. The subscript c includes the activity, participants, relevant history, tools, and practical stakes that shape which correspondences can be considered. The relation may leave some moves without a counterpart. A single move may have several possible counterparts, and several moves may jointly account for what another repertoire treats as one action. The relation can also change as the participants learn, renegotiate a problem, or acquire new resources. Its elements are interpretive units selected for inquiry; their identification depends on the purposes and evidence of the analysis. The representation presupposes that participants or analysts can distinguish and compare some locally relevant moves. Its role is to organize the assessment of particular correspondences; predicting educational success would require an additional empirical model.

The representation helps distinguish three inferences requiring independent evidence: transfer of a correspondence across contexts, equivalence of the operations connected, and agreement on their epistemic adequacy. A successful correspondence for measuring displacement may leave practical skill, causal interpretation, or institutional authority differently distributed.

The context index in Equation 1 also disciplines the interpretation of a successful translation. A practical judgment that two lengths are approximately equal may suffice for fitting a component, while a laboratory procedure requires specified tolerances. Likewise, a learner's ability to use the teacher's notation offers evidence of one kind of coordination; it leaves the direction of understanding and the learner's independent choice of method to be examined separately. Translation may be asymmetric because an educator controls the accepted vocabulary, instruments, or assessment criteria. An accountable correspondence should therefore make its purpose and evidential limits explicit and remain open to correction by participants with relevant knowledge. In some encounters, its most valuable result is the identification of a difference that the shared representation initially obscured.

Translation of expressions concerns what words, symbols, and gestures refer to in context; *translation of inquiry* also concerns the moves by which participants generate, check, and revise conclusions. A shared term can facilitate coordination while these inquiry operations continue to differ.

Aikenhead's account of science education as border crossing into the subculture of science offers a useful disciplinary framing [2]. Scientific learning may require movement among practices organized by different explanatory commitments, social expectations, and forms of recognition. Movement can be supported through explicit attention to the border and to the purposes of different practices. The idea remains instructive when the practices are heterogeneous without being neatly divided into a scientific school and a nonscientific home. Engineers, craftspeople, local observers, laboratory researchers, and young learners can each participate in multiple intersecting traditions. Their distinctions change historically, and particular methods may already circulate among them. The analytical object is the situated crossing between specified practices, with the possibility that several crossings occur within a single inquiry.

A translation may be initiated from either side of an encounter. An educator can begin with a disciplinary procedure and seek an intelligible entry into a learner's activities. A learner can introduce a problem whose treatment requires the educator to reconsider the scope or form of an assigned method. A community participant may contest the assumption that the available data represent the phenomenon adequately. These directions of initiative are pedagogically consequential. If one side alone determines

which expressions count as legitimate and which differences can be retained, the outcome may amount to assimilation into an established repertoire. If participants can make relevant distinctions visible and negotiate the significance of a remainder, translation may become part of a shared inquiry. Negotiation occurs amid differences in authority, available time, and expertise. Accountable teaching makes these differences relevant to the organization of participation.

Work on hybrid mediational practices provides a further point of comparison. Gutiérrez, Baquedano-López, and Tejeda discuss the learning potential of hybrid language practices and multiple, potentially conflicting mediational tools in what they call Third Spaces [28]. This account encourages attention to new activities that can emerge from the encounter of repertoires. The concept of generative invitation develops a narrower question: under which arrangements does an offered problem or form leave the learner substantial authority to elaborate an inquiry, and how can the relation between repertoires be judged? Third Space and generative invitation should remain distinguishable. A hybrid product may emerge under a strongly controlled curriculum, and an invitation may support significant independent inquiry while maintaining several unresolved differences between repertoires. The authority structure of an educational encounter depends on who can propose, evaluate, and revise the shared activity.

The translation relation also has an epistemic dimension that warrants separation from its social success. An activity can coordinate participants and produce an aesthetically satisfying joint representation while making unsupported claims about the world. Conversely, a learner may reach a justified result through unfamiliar means that a teacher initially misreads as inattention or error. A responsible translation must permit examination of how the relevant claims obtain their warrant. That examination may involve numerical checks, controlled comparisons, archival evidence, practical testing, careful observation, or a reasoned interpretation appropriate to the domain. The relevant test varies with the kind of claim and its evidential domain. For example, whether a tool fits a particular component, whether a general mechanical explanation is defensible, and whether an activity ought to be permitted in a shared workshop pose related but distinct questions. The pedagogical task involves identifying these differences publicly enough for learners to use and challenge the resulting judgments.

A constructed case involving bicycle-wheel repair helps distinguish the levels of correspondence. Consider a group in which one learner has experience assessing a wheel by turning it, observing lateral movement relative to a fixed reference, listening for rubbing, and adjusting spokes under guidance. The teacher introduces a geometry lesson in which lateral displacement around the rim is represented as measurements against an angular position, then plotted to compare patterns of deviation. The initial offering has a plausible practical entry point. The learner recognizes the wobble as a familiar object of action, while the teacher can provide measurement conventions, a coordinate system, and methods for representing periodic variation. The constructed case illustrates conceptual distinctions through an imagined educational encounter; actual repair decisions would require appropriate technical expertise.

At the level of *reference*, participants connect graphed values with measured displacement at positions around the wheel. At the level of *operation*, they compare taking a reading, interpreting a sound or tactile cue, and deciding which adjustments to test. The connection is useful to the extent that each participant can explain its purpose and evidential limits.

The graph can serve as a boundary object for discussing recorded displacement. Its usefulness depends on its measurements and conventions; it represents only part of the practical diagnosis. The learner's workshop criteria can also expose dimensions the graph omits and guide further measurements. This is an opportunity for reciprocal revision of the inquiry.

A generative invitation becomes possible when the learner can use the familiar practice to alter a consequential aspect of the investigation. The learner might propose comparing a graph based on visual observation with one based on a measurement tool, ask whether apparent wobble could come from an off-center tire, or examine why repeated readings disagree. These suggestions may require different instruments and different standards of evidence. The teacher can help distinguish hypotheses that the class can responsibly examine from maintenance decisions requiring a qualified mechanic or supervised workshop setting. The learner's question merits investigation through the relevant measurements and mechanical expertise, particularly where a safety judgment is involved. The relation between the peda-

gological and practical repertoires changes when these proposals inform how the experiment is organized and what counts as an informative result.

The same constructed encounter can exhibit three distinct failures. In a *lexical substitution failure*, the teacher replaces the learner's practical terms with textbook labels while leaving the connection between operations and justifications unexamined. In an *assimilation failure*, the teacher treats the graph as the complete and authoritative account of wheel condition, excluding relevant practical distinctions by curricular fiat. In a *romantic correspondence failure*, the teacher assumes that experience with repair already establishes mastery of the geometrical or physical explanation, leaving conceptual gaps untested. These failures arise from different inferences. The first mistakes naming for understanding, the second mistakes a useful representation for an exhaustive one, and the third mistakes practical competence for unrestricted conceptual equivalence. They invite different responses: eliciting reasons, specifying the model's scope, and providing genuine opportunities to learn unfamiliar forms.

A further variation shows that translation can remain productive despite a persistent remainder. Suppose the class constructs reliable plots of displacement, while the learner continues to prefer listening and touch for an initial practical inspection. The difference may reflect distinct tasks, resource availability, or forms of expertise. The class can compare what each practice reveals under specified conditions and purposes. It can investigate what each practice detects under specified conditions and where its limitations become consequential. A learner may also reject the invitation to discuss personal work experience or disclose the circumstances under which practical knowledge was acquired. Such a refusal deserves respect; participation can proceed through an anonymized demonstration or an independently selected object. The adequacy of translation depends partly on whether alternatives remain available without penalizing the learner for withholding private knowledge.

Bidirectionality remains a practical achievement under asymmetric institutional roles. The teacher can learn from repair experience while still controlling grades, tools, and time. Legitimate curricular requirements should be identified as such; optional investigations can then give learners meaningful authority over interpretation and further questions.

Translation should also be distinguished from *appropriation*. An educator may wish to draw upon family, community, or occupational knowledge because it makes formal teaching more intelligible. Such knowledge is embedded in relationships of trust and may be subject to norms about who can disclose, document, or reuse it. A practice may become legible to a school while losing control over its interpretation or circulation. Work on funds of knowledge emphasizes the educational relevance of household and community practices [39, 26]. Educational engagement with such knowledge therefore calls for attention to permission, representation, and the conditions of reuse. Permission, representation, attribution, and the possible return of benefits remain distinct questions. In the present section they function as constraints upon how an interface may be established; their political-economic and institutional dimensions receive fuller treatment later.

Interpretive overconfidence arises when a teacher treats a hesitant or fluent answer as a complete diagnosis of understanding. Hesitation can reflect conceptual difficulty, discourse expectations, privacy concerns, or access barriers. Revisable interpretations can be tested through appropriately chosen alternatives: a diagram, object-based test, counterexample, or further observation. Their comparative effectiveness remains an empirical matter.

Digital mediation adds both access and evidential risk. Transcription, translation, diagram-generation, and language-model outputs may provide useful entry points while introducing errors or privileging a vocabulary. Participants need ways to inspect the correspondence with observations, correct representations, and protect sensitive information. The educational assessment concerns accuracy, scope, and the agency available to human participants.

Mutual intelligibility within one lesson may support later development, whose extent requires separate evidence. Subsequent opportunities to formulate problems, justify choices, and revise interpretations under changed conditions can show whether learners have acquired usable new operations.

Three tests organize the account. *Interpretive accountability* concerns the meaning and stated limits of a correspondence; *consequential coordination* concerns inspectable, revisable actions it enables;

and *reciprocal revisability* concerns participants' capacity to reshape the shared inquiry within justified constraints. A practice may perform well on one dimension and less well on another. Together the tests locate possible points of educational development without presuming one ideal mode of teaching.

The analysis of partial correspondence makes a particular educational question salient. Accounts of situated learning, cultural border crossing, boundary objects, and hybrid mediational practices already offer substantial resources for understanding relations across heterogeneous forms of participation [35, 2, 58, 3, 28]. The concept of generative invitation places a particular question at their intersection: how does an educational offering become intelligible within a learner's developing practices while leaving the learner consequential authority to reshape the inquiry? The relational representation identifies locally workable correspondences alongside differences that remain consequential. The constructed repair case demonstrates possible distinctions among reference, operation, epistemic warrant, and practical purpose, yet remains an analytical illustration. Whether the resulting vocabulary improves the explanation or design of learning beyond existing theories is an open comparative and empirical question.

Pedagogical translation establishes revisable correspondences across practices. It can support coordinated activity and access to unfamiliar methods while leaving meaningful differences visible. Section 7 considers how learners develop warranted knowledge through such opportunities.

7 Knowledge Formation Through the Learner's Own Inquiry

The availability of an educational offering and its intelligibility leave open what a learner can come to know and do through inquiry. This section examines three related achievements: developing a question, producing warranted conclusions, and acquiring capacities for subsequent investigation. It considers the learner's authority over problem formation, the evidential standards of disciplinary work, and the ways investigative repertoires can change through individual and collective activity. A constructed case and a discussion of possible evidence illustrate how these achievements can be distinguished. The argument develops conceptual criteria for later empirical comparisons while keeping the histories of participation and guidance in view.

A learner's *own inquiry* is understood here through consequential participation in the organization of an investigation. The learner may propose a question, transform a received problem, choose among defensible methods, contest an interpretation, establish a new comparison, or decide which uncertainty deserves further examination. These activities make distinct contributions to an inquiry and may be distributed among several participants. Their common feature is that a contribution can make a difference to what is investigated, which reasons are considered, or what follows from the result. Ownership in this sense concerns an exercise of practical and epistemic agency. Learner-directed inquiry can proceed through collaboration, shared intellectual resources, and continuing pedagogical responsibilities. A teacher can introduce the field of inquiry and provide demanding instruction while leaving important decisions responsive to the learner's reasons.

Visible choice provides incomplete evidence of epistemic agency. As discussed in Section 5, selecting an activity within fixed assumptions differs from revising a relevant question, evidential comparison, or interpretation. The analysis therefore follows decisions that change the inquiry's intellectual course.

Definition 7.1 (Learner-directed knowledge formation). For a specified educational setting, *learner-directed knowledge formation* denotes a situated process in which a learner makes consequential contributions to the framing, investigation, justification, or revision of a problem, and in which the resulting claims or competencies can be examined under standards appropriate to their intended use. The expression identifies a mode of participation and a demand for epistemic accountability; it leaves open the extent to which the learner's contributions become durable capacities or publicly shared knowledge.

Definition 7.1 identifies a relation among questions, evidence, revision, and developing capacities. It allows for extensive guidance and collaboration while asking which intellectual decisions learners can make and justify.

Problem formation is a first site of epistemic development. A pedagogical offering may initially present a recognizable occurrence, difficulty, or difference: water collects at an entrance, a familiar device behaves unexpectedly, or two accounts of a community event diverge. Experience makes the occurrence significant, but an investigation requires further specification. Which feature calls for explanation? Which variables can be distinguished? What would count as a relevant comparison? Which consequences matter to participants? Different formulations of an apparently shared problem can make different bodies of evidence salient. A teacher may frame a question so that it admits one established solution; a learner may uncover another, equally legitimate question about the conditions under which that solution applies. The capacity to articulate this difference is an educational achievement in its own right, even when the learner's proposed explanation is later found to be mistaken.

Dewey's account of inquiry offers a philosophical resource for relating problems, evidence, and warranted judgment. His *Logic: The Theory of Inquiry* treats inquiry as a disciplined transformation of a problematic situation through operations of observation, inference, and judgment [18]. The comparison supports an important distinction for this paper: experiencing a difficulty, formulating a tractable question, and establishing a defensible conclusion are related achievements with different conditions of adequacy. A learner's question may draw on situated experience, while the investigation develops additional distinctions and procedures for assessing its claims. Deweyan inquiry provides a conceptual lineage for this movement. The present account adds the further question of how learners acquire consequential authority over particular operations within institutional settings that already specify curricula, standards, and permitted forms of participation.

Teachers can recognize learners' proposed problems while examining their feasibility and evidential demands. A meaningful question may initially exceed classroom resources or pose safety concerns; a revised comparison can preserve the underlying concern in an investigable form. The learner's contribution remains consequential when that negotiation changes what the class investigates.

The second dimension is *epistemic warrant*. Generating a novel claim, expressing a personal interpretation, and providing reasons sufficient for a specified conclusion are separate accomplishments. For an empirical claim, warrant may depend on observation, measurement reliability, comparison, sensitivity to confounding conditions, and the justified scope of generalization. For a mathematical claim, the relevant standards may concern explicit assumptions, proof, and valid inference. Historical interpretation, practical expertise, and literary judgment involve other forms of accountability that require attention to their disciplinary purposes. Heterogeneous standards can support discriminating judgments when their evidential purposes are specified. Assessing a result then involves specifying the kind of claim being advanced and the practices through which it could be challenged or corroborated.

Research on students' practical epistemologies gives this distinction a more specific educational bearing. Sandoval argues that learners' understandings of what inquiry is for, and what counts as an adequate result, deserve investigation alongside their stated beliefs about the nature of science [52]. Chinn, Buckland, and Samarapungavan propose a multidimensional framework that distinguishes epistemic aims, achievements, justification, virtues, and processes [13]. These accounts indicate why a classroom task can engage learners in visible activity without clarifying their underlying expectations about evidence. For the present argument, they support treating the learner's relation to warrants as part of the educational object: the learner may learn to ask not only whether an explanation seems persuasive, but also what would make it adequate, how its reliability can be examined, and which uncertainties remain relevant.

Warrant also has a *procedural* dimension. A learner may understand why a comparison is relevant, how a measurement can mislead, or which evidence would challenge an interpretation. Evaluating this understanding calls for examining explanations and decisions alongside final answers.

This account has affinities with the distinction between classroom inquiry tasks and practices of scientific reasoning. Chinn and Malhotra compare school-based activities with features of authentic scientific investigation and identify divergences in the reasoning demanded by some familiar classroom tasks [14]. The relevance here is conceptual: the authenticity of an inquiry depends in part on what participants actually have to decide and justify. A worksheet may require a student to report a variable while leaving

the design of the comparison, treatment of anomalies, and evaluation of alternative explanations entirely predetermined. A modest local investigation may expose more of those decisions even when its results contribute little to a research discipline. The distinction should be applied carefully. Educational inquiry has legitimate developmental and institutional purposes that differ from professional research, and some structured exercises prepare learners for more consequential decisions. Authenticity functions here as a comparative diagnostic of the reasoning and evidential practices available in a classroom activity.

A third dimension is *explanatory revision*. An inquiry becomes educationally significant when the learner can encounter results that place pressure on a favored interpretation and respond by reconsidering assumptions, methods, or questions. Revision includes several possibilities. A claim may be withdrawn because the evidence contradicts it; its scope may be narrowed because a generalization has exceeded the observed cases; a measurement may be repeated because an instrument is unreliable; or the underlying problem may be reformulated because the original distinction obscures what matters. A revised interpretation can preserve useful parts of a prior account while changing other relations. Such changes are better described as reorganization of an evolving inquiry trajectory than as a simple passage from ignorance to knowledge. A trajectory can branch, return to earlier questions, and retain unresolved differences.

Revision requires evidential appraisal. Learners may change a conclusion because of persuasive authority, social pressure, or better observations; only the latter kind of reason directly supports an epistemic improvement. Attention to the basis for revision keeps inquiry responsive to warranted disagreement.

Explanation-driven inquiry illustrates how conceptual and epistemic support may be combined. Sandoval and Reiser describe designed learning environments in which tools and social supports orient students toward constructing and evaluating scientific explanations [53]. Their research provides an established comparison for specifying the supports and evidence relevant to the present proposal. It shows that learners' freedom to pursue a problem can coexist with deliberate structuring of evidence, representation, and critique. In terms of generative invitation, a teacher may make a question accessible through an existing repertoire and then provide further tools that allow the learner to assess a claim whose warrant extends beyond that repertoire. Whether and when those tools should be withdrawn is a further pedagogical issue taken up in the next section.

A constructed case can make the distinctions concrete. Consider a secondary-school group investigating rainwater that repeatedly pools near an entrance used by students and other community members. One learner notices that pooling appears to vary across different types of rainfall and proposes to compare the relevant conditions. Another suggests that an apparently level paved area may conceal a shallow gradient. A teacher offers basic mapping resources, access to school-approved observations, and instruction on safe measurements. The group develops a question about which observable conditions correspond to the pooling pattern. The constructed scenario explores possible educational decisions and outcomes through invented participants and circumstances.

The initial problem is informed by situated experience. Participants who use the entrance may be sensitive to differences in accessibility, walking routes, and the consequences of water accumulation. Those concerns can make certain observations worth investigating. They do not, by themselves, establish why the water collects. The teacher introduces distinctions among surface slope, drainage points, ground cover, rainfall intensity, and antecedent conditions, while explaining that several processes might be involved. The learner retains a significant role by deciding which comparisons answer the locally important question, by contesting the assumption that all rainfall events are equivalent, and by identifying circumstances in which the group's observations may be incomplete. An invitation is substantive here because the learner's concerns can change the investigation's structure, even while disciplinary methods constrain its conclusions.

Suppose the group first maps surface contours using an approved method and compares locations where water was observed. The map may indicate that a low area coincides with pooling, but the association does not establish that topography is the sole cause. The group may examine whether surface drainage is blocked or whether the timing and intensity of precipitation are relevant. A learner might argue that pooling after brief intense rain differs from pooling after prolonged rain; another might ask whether the observation schedule missed events. The teacher's contribution is to help the group articu-

late the inferential consequences of these alternatives. Each possibility calls for a different comparison, and some require data or permissions that the classroom cannot obtain. Recognizing those limits is part of a defensible outcome. For safety, the constructed exercise assumes observation from permitted areas, without entering flooded infrastructure or manipulating drainage facilities.

The group's achievement may be a bounded explanation, a justified rejection of an initial hypothesis, or recognition that available data support only limited conclusions. Such outcomes can be educationally valuable. Claims about learner agency depend on decisions affecting the question, comparison, interpretation, or further investigation.

The case also exposes a distinction between an *epistemic result* and a *capacity to inquire*. A group may produce a defensible report because a teacher repeatedly selects appropriate tests, notices confounders, and resolves interpretive conflicts. The final report would then offer evidence of a successful collaborative achievement, while providing limited evidence that particular learners can organize related investigations under altered conditions. A stronger developmental claim would require examining their subsequent actions: can they formulate a comparable question elsewhere, identify what needs to be measured, explain the relevance of an alternative hypothesis, or recognize a failed comparison with different tools and assistance? Assessing such capacities requires records of the learner's explanations, choices, revisions, and later investigations, together with the degree of support available in each setting.

Generativity concerns the learner's developing operations for producing and assessing further questions. Acquiring a distinction between rainfall intensity and duration becomes evidence of this capacity when the learner can use it in another relevant investigation; reproducing the definition on request supports a narrower conclusion.

Inquiry is frequently distributed across people, tools, and institutions. Participants may contribute complementary observations, arguments, graphical representations, technical expertise, and access to materials. Scardamalia and Bereiter describe knowledge-building communities as an educational orientation in which the advancement of shared knowledge becomes a collective aim [54]. Their account makes it important to distinguish an individual's developing capacity from improvements in a group's jointly maintained knowledge. A learner may have substantive epistemic agency by asking a question that reorganizes a collective project, while relying on another participant to execute a measurement or validate a calculation. Equally, a well-functioning group may produce a strong collective result while leaving some members with limited participation in consequential decisions. The framework consequently examines both collective achievements and evidence concerning each participant's developing capacities.

Epistemic work may include observation, criticism, local familiarity, technical measurement, and organization. These contributions should be evaluated by their evidential role, while respecting permission to share personal or community knowledge. Questions of recognition and institutional control receive fuller treatment in Section 10.

Digital tools may widen the comparisons learners can make while obscuring assumptions through polished outputs. A proposed drainage explanation, for example, should remain open to inspection against observations, alternative causes, and the data supplied to the tool. The educational question concerns the learner's ability to interrogate and use the representation responsibly.

Inquiry capacity develops across changing conditions. Learners may progress from noticing relevant observations to representing them and critiquing the resulting model; others may develop sensitivity to the provenance of questions after mastering formal methods. Longitudinal assessment should attend to available resources and opportunities, since demonstrated performance depends partly on context.

For evaluation, the present account proposes separating four evidential questions. *Problem agency* concerns the learner's consequential participation in selecting, framing, or reframing questions. *Epistemic accountability* concerns the quality and explicitness of the reasons supporting a claim, together with the learner's ability to examine objections. *Revisability* concerns how inquiry is reorganized in response to evidence, methodological limitations, and alternative perspectives. *Generative reach* concerns whether the learner can mobilize developed resources in relevant new investigations, with the assistance and constraints made explicit. These questions may be studied through records of discussions, revi-

sions to artifacts, comparisons of decisions under different supports, and the reasons participants give for their choices. They organize philosophical comparison and could inform the development of context-sensitive empirical indicators. Their interpretation requires a specification of the educational domain, practical stakes, and reasonable standards of evidence.

Several causal alternatives deserve attention before attributing an educational change to generative invitation. A learner's increased activity may reflect familiarity with a topic, greater access to equipment, reduced language barriers, peer support, or ordinary maturation. Improved written explanations may result from direct teaching of a format while the student's problem-formulation practices remain unchanged. Conversely, a learner's apparent disengagement may arise from institutional penalties for disagreement, inaccessible materials, or obligations outside the classroom. Inquiry-oriented teaching itself includes multiple traditions with established conceptual resources. Research on scaffolded problem-based and inquiry learning emphasizes the role of guidance in designing meaningful investigations [30]. Comparative evaluation should therefore consider scaffolding, learner selection, resource availability, and the distinctive decisions enabled by an invitation.

The specific explanatory claim open to evaluation is therefore modest. The paper proposes that a learner's existing generative repertoire can supply an intelligible entry point for an educational offering, while the offering can make further operations available that the learner comes to use in framing and assessing problems. The decisive analytical relation is between the offered opportunity and the learner's consequential, epistemically accountable activity. Existing work on problem-posing, situated learning, epistemic cognition, and knowledge-building already investigates significant parts of this relation [24, 35, 52, 54]. The additional value of the present vocabulary would depend on whether it clarifies translation across heterogeneous repertoires, identifies otherwise overlooked restrictions on problem agency, or supports more discriminating comparisons of educational trajectories. These potential contributions remain hypotheses for theoretical development and empirical study.

Inquiry can combine learner initiative with explicit technical teaching, calibrated correction, and justified safety constraints. Section 8 examines how responsibilities and learner discretion can change as competence develops.

Learner-directed knowledge formation thus involves distinguishable achievements: posing a question, reaching a warranted conclusion, and developing capacity for future inquiry. The quality of guidance helps determine how these achievements become possible.

8 Guidance, Scaffolding, and Learner Autonomy

Teacher expertise, institutional responsibility, and learner autonomy shape the conditions under which inquiry can develop. This section examines the allocation of guidance and authority as learners encounter questions and acquire the means to investigate them. It distinguishes contingent instructional assistance from the broader distribution of decisions over problems, methods, and evaluation. Research on scaffolding, autonomy-supportive teaching, formative assessment, and inclusive pedagogy informs a constructed case of changing pedagogical responsibility. The analysis considers how disciplinary correction and learner agency can be sustained together under different educational constraints.

Guidance names a family of educational activities with different purposes. A teacher may introduce a field of problems, demonstrate an operation, call attention to a neglected variable, make specialized equipment available, supply contextual information, challenge an inference, or establish a safety boundary. These acts differ in the degree to which they specify what a learner should do and in the kinds of responsibility they retain for the teacher. A demonstration can provide a learner with an operation that becomes available for later use. A leading question may channel learners toward a predetermined answer while narrowing opportunities to investigate competing explanations. Both interventions can be appropriate in particular circumstances. Their educational significance depends upon the subject matter, the learner's evolving capacities, the relevant stakes, and the relation between immediate assistance and subsequent action.

The familiar notion of *scaffolding* offers a starting point. Wood, Bruner, and Ross examined tutoring in problem solving and described how adult support can organize a task beyond what a child presently accomplishes alone [64]. Reviewing teacher–student interaction studies, van de Pol, Volman, and Beishuizen identify contingency, fading, and transfer of responsibility as central characteristics of scaffolding and distinguish instructional means from their purposes [44]. Their review also documents methodological variation and a limited body of effectiveness studies, making the identification of scaffolding in a particular episode an evidential task. Contingency concerns responsiveness to the learner’s observed needs and actions; fading concerns changes in the assistance supplied; transfer of responsibility concerns the learner’s increasing participation in the work formerly carried by the tutor. These characteristics supply a more discriminating description than the simple image of a teacher progressively withdrawing from a task.

Contingency involves judgments about learners’ current understanding from partial evidence: attempts, questions, artifacts, and practical constraints. A hesitant response may reflect a conceptual obstacle or a barrier to participation. Assistance should therefore remain adjustable as additional evidence appears.

Fading changes the distribution of work. A teacher may withdraw a template as competence develops while introducing new support for unfamiliar tools or criteria. The relevant question is which decisions learners can now make and defend, rather than how little assistance remains.

Transfer of responsibility concerns the scope of acquired authority. Proficiency in executing a method may develop before responsibility for selecting problems or scrutinizing conclusions. Guidance can make these different trajectories visible.

The allocation of responsibility may change along several dimensions at different rates. A learner can reliably operate an instrument while still relying on the teacher to judge whether its readings warrant a general conclusion; another may identify a compelling problem before acquiring the technique needed to investigate it safely. A practical review of guidance therefore asks who currently identifies mistakes, selects alternatives, requests assistance, and authorizes consequential actions. Decisions about reducing support should be responsive to observed competence and to the possible consequences of error. The teacher may retain a protective or professional duty even where the learner has developed considerable epistemic initiative. This differentiation gives transfer of responsibility a more determinate role than the simple reduction of adult intervention.

Definition 8.1 (Responsibility-sensitive pedagogical guidance). For a specified educational inquiry, *responsibility-sensitive pedagogical guidance* denotes the situated provision, adaptation, and evaluation of assistance with attention to (i) the competencies and opportunities available to participants, (ii) the epistemic and practical stakes of decisions, and (iii) the conditions under which learners can assume, share, contest, or request support for consequential responsibilities. The definition describes a proposed analytic perspective. Its use in educational research would require operational definitions and context-specific validation.

Definition 8.1 distributes responsibilities by purpose. Teachers may retain laboratory safety duties while learners direct a question; language instruction may combine grammatical correction with learner-chosen topics. Such allocations are educationally significant when reasons and opportunities for revision are intelligible.

Instructional research cautions against equating meaningful learner agency with the absence of structured teaching. Kirschner, Sweller, and Clark argue that minimally guided instruction can impose difficulties on novices in view of cognitive architecture, prior knowledge, and working-memory limitations [33]. Hmelo-Silver, Duncan, and Chinn respond that problem-based and inquiry learning can incorporate substantial scaffolding and that comparisons must distinguish scaffolded inquiry from unguided discovery [30]. These arguments concern overlapping educational questions while differing over the instructional arrangements represented by the relevant categories. The present paper has limited grounds for resolving their empirical disagreement. It adopts a narrower analytical requirement: the amount and timing of guidance should be justified in relation to the task, the learner’s experience, and avail-

able evidence about learning. Consequential learner participation can coexist with direct instruction in disciplinary methods and shared standards.

Worked examples and direct instruction can expand the questions novices are able to investigate. Open inquiry also requires appropriate conceptual support. The analytical issue is how educators connect instruction to consequential decisions over questions, evidence, and interpretation.

Educational *autonomy* has several meanings whose conflation can conceal important differences. Motivational autonomy concerns the learner's experience of volition and endorsement in an activity. Epistemic autonomy concerns the capacity and opportunity to form, assess, and revise judgments under appropriate standards. Practical autonomy concerns consequential control over activities, resources, and the uses of produced knowledge. Institutional autonomy concerns the rules and power relations that permit or restrict these activities. These dimensions interact, and each calls for evidence suited to its educational role. A learner may feel motivated by an assigned task yet have limited authority to change its question. A learner may also develop a sound independent judgment within an institutional arrangement that permits little influence over publication or evaluation.

Ryan and Deci's self-determination theory attends to autonomy, competence, and relatedness as dimensions of motivational development under social conditions [49]. Reeve's account of autonomy-supportive teaching explicitly associates the support of students' motivational resources with a classroom providing substantial structure [46]. These sources furnish a useful corrective to a simplistic opposition between guidance and freedom. Questions of authority over evidence, problem formulation, and institutional consequences extend this motivational analysis into educational governance. Generative invitation proposes an additional question about the relation between the learner's existing repertoire and the operations made available by an educational encounter. Whether that question identifies an empirically separable mechanism remains to be established. The motivational and philosophical vocabularies illuminate related dimensions of autonomy at different levels of analysis.

Disciplinary expertise supports warranted correction: a teacher can identify invalid calculations, unreliable instruments, or claims contradicted by evidence. Explaining these grounds gives learners access to relevant standards and opportunities to revise their judgments.

The treatment of *error* provides a practical test of these relations. Some errors can be identified against stable, shared criteria: a unit conversion is inconsistent, a historical date has been misread, or a physical measurement lacks calibration. Other disagreements concern the framing of a problem, the significance of selected evidence, or competing ethical priorities. A teacher should be able to state which kind of issue is being corrected. A learner who proposes a technically weak explanation may nonetheless identify a valuable neglected question. A compelling personal narrative may motivate investigation, while a general causal conclusion calls for additional evidence. Responsible feedback can recognize the epistemic contribution contained in an attempt while identifying what further evidence or revision it requires. This distinction preserves the intellectual standing of the learner and the obligations of disciplinary judgment.

Assessment research offers further resources for understanding correction as part of continuing inquiry. Sadler's account of formative assessment emphasizes the relation between criteria for quality, judgments about performance, and the learner's ability to improve a response [51]. Black and Wiliam survey formative assessment and the significance of feedback and student self-assessment within classroom learning [9]. Shute's review discusses feedback that addresses task features, provides useful explanation, and responds to the learner's cognitive demands [56]. These approaches support a distinction between feedback that makes a judgment intelligible and a judgment whose educational force rests primarily on institutional authority. An intelligible explanation creates a basis for discussion and justified correction, although agreement remains contingent. It proposes that meaningful opportunities to examine the criteria and use them in subsequent work are relevant evidence when assessing the educational character of correction.

Assessment can inhibit challenge when teachers both guide inquiry and assign consequential grades. Observable opportunities for learner judgment therefore depend partly on whether students can question an interpretation without an arbitrary penalty and whether evaluation criteria distinguish required

competence from discretionary choices.

This concern also clarifies the status of refusal. A learner may decline to disclose a household practice, decline an invitation to participate in public presentation, or reject a proposed interpretation while still meeting legitimate educational requirements through another form of contribution. Where a curriculum specifies a necessary competency, the learner may remain obliged to demonstrate it. The pedagogical question becomes whether available demonstrations of competence are unnecessarily restricted to one form of expression or to the disclosure of experiences the learner has reason to keep private. An invitation becomes more credible when its terms distinguish voluntary contributions from compulsory standards, and when the learner can request assistance or alternative modes of participation without disproportionate disadvantage.

Accessibility makes these distinctions material. A classroom may offer several formally identical tasks while their demands on language, vision, mobility, time, sensory processing, or access to equipment create sharply different opportunities to participate. Providing a common instructional object can coexist with differentiated routes through which learners encounter, examine, and communicate its content. Drawing on observations and interviews with eleven teachers in two Scottish primary schools, Florian and Black-Hawkins examine inclusive pedagogy through efforts to extend learning opportunities ordinarily available to the whole class [23]. Their qualitative study helps locate the conditions of participation within specific teaching arrangements, while the further implications for accessible generative invitations are developed here as a proposal. A generative invitation is consequently evaluated through the usability of its materials and the consequences attached to recognized forms of response.

Accessibility measures should preserve the intellectual objective while adapting incidental barriers. Oral, diagrammatic, assistive, and written responses may all demonstrate causal reasoning, whereas an assessment of written composition has different requirements. Educational equivalence is therefore specific to the competence being evaluated.

A constructed educational scenario helps clarify these tensions. Consider a class investigating summer heat exposure along routes used by residents to travel between a neighborhood and a local public facility. A student familiar with caring for younger children suggests that the shortest walk may expose pedestrians to long, unshaded crossings. Another student proposes estimating heat exposure by recording air temperature at several points. The teacher initially offers a simple mapping task and a small number of portable sensors. These elements make a question investigable, yet they leave open what *heat exposure* should mean, which routes matter, and which observations would justify a recommendation. The case is a philosophical construction. The scenario serves as a conceptual comparison of teaching arrangements and uses imagined thermal observations for illustration.

At the outset, the teacher may supply essential direct instruction on the difference between air temperature, surface temperature, radiant heat, and the conditions under which a low-cost sensor can yield misleading readings. The teacher can also establish practical boundaries on travel, equipment handling, and the disclosure of participants' locations. These interventions constrain particular activities for intelligible epistemic and protective reasons. The learner's initial observation about walking with younger children remains relevant because it identifies a practical problem that a point measurement alone may inadequately represent. A teacher who reformulates the learner's question as a map of air temperatures may produce a useful mathematics exercise with a narrower practical scope. A teacher who invites comparison between plausible indicators distributes additional responsibility for framing the inquiry while continuing to explain measurement quality.

Suppose the group initially finds similar air-temperature readings along two routes but observes differences in shade, waiting time at crossings, and the availability of rest areas. One response is to infer that the routes are equivalent in heat-related experience because the available sensor readings are similar. The teacher can challenge this inference by asking which quantity the sensors measure, under which conditions they were used, and whether the practical claim exceeds the evidence. The correction should identify the unsupported inference with sufficient precision for students to revise it. A further question arises from the learners' own observations: which combination of environmental and practical features is appropriate for comparing the routes? The class may develop a more careful, explicitly qualified com-

parison while continuing to acknowledge unresolved measurement limitations. Any proposed indicator in this scenario would require technical validation before informing public-health decisions.

The organization of support can change as this inquiry develops. Early stages may involve instructor-prepared examples of sensor error and a shared method for recording observations. Later stages may permit students to select comparison routes, document uncertainties, and decide which observations remain relevant to their proposed question. The teacher may retain responsibility for equipment safety, curricular criteria, and the evidential conditions for claims made in the school's name. Students may retain or acquire responsibility for contesting assumptions, explaining why a route matters, and identifying further measurements that would be needed. The redistribution is multidimensional. Technical assistance may increase precisely when students choose a more demanding question. A reduction in teacher intervention would therefore be a misleading proxy for the development of autonomy.

The scenario also permits attention to participation and recognition. A learner who can identify route hazards through experience may prefer to contribute a narrated route description rather than a publicly displayed map containing details of family movements. Another learner may be especially capable at comparing tables or explaining sensor uncertainty. These differences can become complementary sources of inquiry, provided the assessment specifies which forms of individual understanding require demonstration. If the class considers publishing a map, the scope of consent, attribution, and the possibility of misleading external use require separate decisions. The teacher's legitimate responsibility for institutional publication differs from the student's authority over voluntary experiential disclosures. The broader questions of appropriation, contribution, and the return of educationally produced knowledge will receive independent treatment in the analysis of institutional power.

The heat-inquiry case distinguishes accurate execution of a prescribed measurement from learners' justified decisions about routes, relevant variables, and model limitations. Both can support learning; the latter provides clearer evidence about consequential problem agency.

Evaluating guidance requires records of questions opened to learners, methods supplied by teachers, stated correction standards, and responses to unexpected proposals. Changes to tasks and assistance provide stronger evidence than completed artifacts alone.

A stronger test would examine alternative explanations for any observed improvement. More structured instruction, increased equipment access, sustained formative feedback, subject familiarity, and collaborative support may independently improve performance. Theories of scaffolding, self-determination, and inclusive pedagogy already address major parts of these mechanisms [44, 46, 23]. An assessment of generative invitation would need to identify what its vocabulary adds beyond established accounts. For example, it might clarify how a teacher's offering becomes intelligible through a learner's historically formed repertoire, how a learner's proposed revision can transform the operative problem, or how a capacity for subsequent inquiry emerges without requiring complete independence from support. Each possibility requires a research design capable of distinguishing interpretive plausibility from attributable educational effects.

The allocation of authority varies with risk, competence, and collective obligations. Standard procedures and close supervision may remain appropriate in technical training; learners can still gain increasing discretion over the questions to which those procedures are applied.

Responsibility-sensitive guidance connects expertise and justified correction with meaningful learner discretion. Its adequacy depends on opportunities to apply developing competence under the conditions of a particular inquiry.

9 Culturally Situated Education and Participatory Knowledge Production

Culturally situated educational practices influence how problems become intelligible, which resources learners can draw upon, and who participates in judging the resulting knowledge. This section examines culture as an evolving configuration of practices and relationships, with attention to variation within

communities and overlapping histories of participation. It compares culturally relevant and sustaining pedagogy, situated design, and participatory educational inquiry. A constructed community case illustrates how recognition of a practice, authority to shape a question, and warrant for a conclusion remain distinct concerns. The analysis develops criteria for assessing educational co-creation in its social and institutional settings.

Culture is used here to refer provisionally to historically reproduced and transformable configurations of practices, relations, expressive resources, norms, and material arrangements. It emphasizes developing practices and relations that vary within groups as well as across them. People participate in overlapping repertoires across homes, occupations, languages, digital networks, institutions, and places. Their participation can also be unequal and contested. A young person may learn the practical rhythms of a family workshop while rejecting some of its expectations; another may share a language with a teacher but differ in the uses to which that language has been put. Consequently, understanding a learner's available knowledge calls for attention to participation and experience beyond institutional identity categories. Responsible pedagogical interpretation begins with situated participation and remains open to correction by those whose practices are under discussion.

Culturally relevant pedagogy supplies an important lineage for this discussion. Ladson-Billings developed a theory from research with exemplary teachers of African American students, explicitly addressing the relation among cultural practices, teaching, and educational research [34]. The significance for the present inquiry is methodological as well as normative: the organization of teaching warrants analysis within concrete social relations, including who defines academic success and which practices are treated as resources. Paris subsequently argues for a *culturally sustaining* orientation that values the continued vitality of the languages, literacies, and cultural practices of communities marginalized by structural inequalities [42]. These positions invite attention to different educational questions. Making instruction intelligible through a familiar resource is one possible pedagogical achievement; contributing to a community's capacity to maintain, revise, or transmit valued practices is a further concern. Evidence for either outcome depends on how learners engage in the activity and how their capacities develop.

Cultural references become consequential when they affect questions, methods, evidence, or interpretive authority. A familiar image can assist engagement while leaving the task unchanged; practices that learners can investigate or adapt offer wider opportunities for inquiry.

Research on *funds of knowledge* provides a particularly instructive comparison. Moll and colleagues describe collaborative research with working-class Mexican households in Tucson, Arizona, in which teachers and university researchers investigated household practices and developed connections to classroom instruction [39]. This situated project illustrates how teachers can become investigators of resources already developed in learners' households. The approach reverses the assumption that professional educators already possess an exhaustive map of educationally relevant resources. Household experience may become a site of inquiry for teachers themselves. Engagement with household knowledge also requires attention to consent, time, trust, and the discretion of potential contributors. Access depends on trust, the specific purpose of a visit, the burdens of participation, and the right to limit disclosure. The conceptual significance of funds of knowledge for generative invitation lies in a changed educational relation: pedagogical planning can become responsive to knowledge whose practical formation lies outside the school's usual channels of recognition.

A culturally situated offering may also disclose differences among epistemic orientations. Bang and Medin investigate science education in relation to Indigenous communities and argue for learning environments that support navigation among multiple ways of knowing, including culturally situated orientations toward nature and scientific practice [4]. Such research is particularly important where a school science curriculum presents its investigatory conventions as culturally transparent. A learner may encounter differences in which relations are salient, how an environmental question is framed, or what obligations accompany the use of a place. Evaluating a specific empirical claim continues to require appropriate evidence and methods. Measured changes in temperature, for example, require attention to appropriate instruments and uncertainty; decisions about the significance of those changes may additionally depend on historical knowledge, relationships to place, and collectively articulated priorities. The

two kinds of accountability can interact without becoming interchangeable.

Epistemic navigation concerns learning to articulate the purposes, standards, and partial correspondences among practices. It can involve disciplinary mastery alongside greater capacity to explain what is preserved, altered, or omitted when knowledge travels across contexts.

A related analysis appears in Gutiérrez's account of a collective *Third Space* and sociocritical literacy, grounded in research with a particular educational programme. The work examines the formation of learning spaces in which everyday and institutional literacy practices can be reorganized through participants' sociohistorical lives and critical reflection [27]. For the present paper, the account shows how pedagogical translation can transform both the learner's participation and the forms available within a classroom inquiry. Educational encounters may yield hybrid forms in which the learner, the teacher, and the available forms of representation are jointly modified. Such modification can be valuable where it expands participants' capacities for justified inquiry. Its value and legitimacy nevertheless require examination within the relations that made the hybrid activity possible.

Culturally Situated Design Tools, developed by Eglash and collaborators, offer a more technologically specific comparison. Their work describes computational environments informed by cultural design practices, together with negotiations involving community participants, teachers, and students concerning representation and software design [20]. The study is relevant because computational forms can become objects of creation and interpretation through participants' activity. Decisions about which features of a practice can be modeled, which transformations remain recognizable, and how a learner may vary a design are simultaneously mathematical, technical, and cultural decisions. Understanding what the software represents and what participants learn from it requires examining the modeled practice and the learners' activity. Those are distinct questions for analysis and empirical assessment.

The connection to the wider tradition of *generative value* deserves proportionate acknowledgment. Eglash and related research have already emphasized generative practices in which participants produce and transform valued forms through recursive or locally organized processes. The present manuscript builds upon this inheritance while posing a more specific pedagogical question: under which conditions does an offered form become available for a learner or community to pursue inquiries that they can meaningfully direct, justify, and revise? Answering this question requires attention to instructional relations and standards of evidence as well as to the generative richness of the underlying practice. A community design can be highly generative and still become educationally restrictive when its implementation reserves consequential decisions for a software designer or institution.

Participatory design also concerns *who can revise the design*. Teachers may choose materials initially, while learners and community collaborators can influence the questions, evidential comparisons, representations, and circulation of results. The extent of this authority should be examined through actual decisions.

Research on Indigenous technologies provides a concrete reason for this care. Bang, Marin, Faber, and Suzukovich derive design principles from a community-based project concerned with science learning among urban Indigenous youth, foregrounding cultural relations to technology and ecological contexts [5]. The study should be understood in its particular community and research setting. It nonetheless illustrates why a generic invitation to "include culture" is analytically insufficient. The meaning of technology, the authority to describe it, and the purposes of design may be integral to the educational question. A tool designed to help students appropriate a predefined technological framework can embody a markedly different relation from one in which participants examine existing technological knowledge and collaborate in determining what the tool should do.

Educational collaboration brings differentiated expertise. Teachers may contribute experimental design, learners observational questions, and practitioners knowledge of material constraints. Meaningful co-creation requires accountable consideration of such contributions while preserving the standards appropriate to each inquiry.

For the present analysis, *participatory knowledge production* names an educational arrangement in which multiple participants can make consequential, accountable contributions to the formation or revision of questions, methods, representations, and interpretations. Participation can take many forms, and

the relevant participants may have unequal time, resources, and responsibilities. Knowledge production is qualified by the adequacy of the resulting claims to their intended purposes and by the possibility of reasoned challenge. The definition describes how inquiry is organized; judgments of democratic legitimacy and evidential soundness require further criteria. A joint project may generate an accurate description while distributing decision-making inequitably; it may distribute choices more fairly while reaching a poorly justified conclusion. These possibilities need separate evaluation.

A school–community collaboration can be examined through three related decisions. The *agenda decision* concerns which circumstances are represented as educational problems and whose reasons establish their significance. The *interpretive decision* concerns what observations, methods, and testimony are used to develop and assess a claim. The *continuation decision* concerns whether participants can revise the inquiry, apply its resources in another setting, or withdraw from particular uses of the resulting material. Responsibility for these decisions may be distributed among different participants or institutions. They may be redistributed during an investigation as knowledge and responsibilities develop. Their separation helps distinguish substantive participation from the mere visibility of multiple contributors in a classroom activity.

Reciprocity adds an important qualification to these decisions. Community collaborators may spend time explaining practices, offering materials, and responding to student work. They may also receive useful representations, new questions, or practical educational opportunities. Reciprocity should be examined through what the participants consider relevant and what the arrangements actually permit. A polished classroom presentation, an acknowledgement, or an invitation to an exhibition may be welcome; it may also fall short of the contribution collaborators intended. Examining three organizational efforts within a regional cross-sector educational initiative, Ishimaru identifies reciprocal, relational, and collective strategies for family engagement alongside constraints on their implementation [31]. This literature directs attention to institutional responsibilities for representing, circulating, and returning the outcomes of community participation.

Community collaborators may disagree about disclosure, conservation, or the use of a practice. A participatory arrangement needs a defensible way to hear these differences and allocate authority under applicable obligations; community membership alone cannot resolve competing claims.

A constructed case clarifies the distinctions. Consider a secondary-school science course and a local seed-saving group whose members maintain several varieties of edible plants. The course includes germination, variability, environmental conditions, and the interpretation of experimental evidence. A teacher proposes that students investigate why some saved seeds germinate differently across storage and planting conditions. Group members already use practical discriminations concerning seed maturity, humidity, seasonal timing, soil texture, and the histories of particular varieties. The hypothetical collaboration provides a context for comparing possible educational arrangements and their evidential demands. Its purpose is to examine how a culturally and materially situated practice can influence the organization of a disciplinary inquiry.

The teacher initially offers laboratory instruments, record sheets, elementary statistical methods, and an explanation of why controlled comparisons may be useful. Seed keepers contribute historical observations, distinguish varieties that the classroom initially grouped together, and explain which practical outcomes matter to them. Students may propose several investigations: the association between storage conditions and germination, the effects of available light during early growth, or the relation between germination rates and subsequent plant vigor. The educational opportunity resides partly in the capacity to reformulate the original problem. A learner might recognize that a high germination rate is insufficient for a group's purpose if the resulting plants do poorly in the planting environment. Another might observe that older records use distinct local names for seeds the laboratory identifies under a single category. These contributions change the relevant comparisons and require explanation.

Each proposed investigation has different evidential demands. If students compare germination proportions, they must consider the selection of seeds, sample sizes, exposure conditions, measurement reliability, and the scope of any statistical inference. A correlation between storage humidity and germination may motivate further controlled testing, while leaving the causal mechanisms open to further

investigation. If students investigate vigor in the planting environment, the design may require observations across different sites or seasons, with limits on generalization stated explicitly. If local naming practices become an object of inquiry, interviews, historical records, and interpretive comparison introduce standards that differ from the laboratory measurement. A productive collaboration permits these methods to coexist where they address genuinely different questions, and asks what evidence could connect their conclusions.

The seed-saving group may legitimately set conditions for the use of particular knowledge or materials. Some varieties may be unavailable for experimental consumption; a family narrative may be offered only for classroom discussion; an account of a planting practice may require attribution to an identified contributor or agreement concerning further disclosure. Students can investigate public data or develop alternative experimental materials when a constraint makes a proposed test inappropriate. Such limits are part of the practical environment in which responsible inquiry takes place. They may also prompt new questions concerning provenance, evidence, and the consequences of representation. The present section treats these boundaries as conditions of participation; the detailed questions of ownership, appropriation, and the return of knowledge are reserved for the following section.

The seed-saving case permits comparison among a decorative lesson using familiar materials, a consultation that collects community observations, and a collaboration where participants can revise questions, methods, and disclosure plans. The latter arrangement gives fuller expression to participatory knowledge formation, though its educational benefits remain a matter for investigation.

These arrangements also call for distinct evidence. A decorative reference can be assessed for accessibility and accuracy of presentation. Consultation requires a record of whose observations were requested, how they were interpreted, and whether contributors could correct the resulting account. A participatory arrangement additionally requires tracing which decisions were changed through the contributions and who retained authority over subsequent uses of the material. A contribution may prove intellectually decisive while leaving publication subject to justified restrictions; another may be warmly acknowledged while having little effect on inquiry. Comparisons of culturally situated pedagogy are more informative when they track this range of consequences alongside learning outcomes. In this way, cultural responsiveness, epistemic warrant, and participation can be evaluated as related achievements with distinct evidential demands.

A further version exposes a more difficult situation. Suppose students produce a digital seed catalogue combining photographs, germination data, and oral histories. A highly capable student builds a searchable interface, and the school proposes publishing it openly. The technical achievement may be substantial, yet the publication decision introduces questions beyond the student's programming competence or the teacher's scientific expertise. Some recorded narratives may be suitable for wide circulation; others may have been shared for a restricted educational purpose. The catalogue's creation demonstrates capacities for representation and collaborative work, while decisions about the permissible audience, corrections, and future uses involve contributors whose authority is differently grounded. The case illustrates why pedagogical success, epistemic adequacy, and relational legitimacy deserve separate analyses, even when they arise within a single project.

Digital tools can assist seed cataloguing, visualization, and simulation, while introducing errors or changing who can reuse shared knowledge. Design decisions should specify permissions, data handling, verification, and meaningful community input.

A conceptual assessment of participatory inquiry should therefore include at least four dimensions. *Interpretive fidelity* asks whether the educational representation preserves the distinctions relevant to its stated purposes and whether affected participants can identify consequential omissions. *Epistemic accountability* asks whether claims are open to appropriate tests, counterevidence, and revision, including when methods from different traditions address different questions. *Participatory consequence* asks which learners and collaborators can materially alter questions, methods, or interpretations, and under what restrictions. *Developmental reach* asks whether the encounter expands participants' capacities to continue inquiry beyond the immediate artifact or task. These dimensions are provisional criteria for comparative analysis. Their relative importance depends on the educational purposes, domain-specific

evidence, and practical consequences of error; empirical use would require further specification.

The four dimensions can diverge: accurate representation may coexist with little participatory authority, and open participation may still require stronger evidential methods. Their value lies in identifying the specific achievements and compromises of an arrangement.

Several alternative explanations require deliberate consideration. Increased engagement may follow from a novel activity, a familiar topic, a sympathetic teacher, improved equipment, reduced language barriers, or the presence of respected community participants. Stronger scientific reasoning may result mainly from explicit instruction in measurement and comparison. Wider community participation may result from changes in institutional scheduling or support rather than from the use of a culturally situated form. Existing research on relevant and sustaining pedagogy, funds of knowledge, Third Space learning, and community-based design already provides conceptual resources for describing many of these changes [34, 42, 39, 27]. The distinctive explanatory value of generative invitation can be tested through its account of the offered activity, learners' uptake, and the consequential development of inquiry.

Culturally situated inquiry treats evolving practices as resources and possible subjects of knowledge formation. Its contribution is assessed through epistemic adequacy and participants' consequential roles, alongside the historical and institutional conditions shaping participation. These arrangements also raise questions about the governance of curricular materials, datasets, and public explanations. Section 10 considers recognition, institutional power, and the return of knowledge to its contributors.

10 Recognition, Institutional Power, and the Return of Knowledge

Knowledge formed through educational participation may circulate beyond the activity that produced it. Its interpretation, attribution, preservation, and reuse are shaped by institutional decisions affecting learners, educators, and communities differently. This section examines the relation between epistemic recognition and authority over these decisions. It develops a provisional account of the *return of knowledge* as continuing access, warranted participation, and opportunities for further inquiry, while attending to privacy, consent, and legitimate restrictions. Research on epistemic injustice, participatory education, and data governance informs a constructed case and the associated ethical analysis. The account is philosophical and normative; specific legal rights and the effectiveness of proposed arrangements require context-sensitive assessment.

An inquiry can succeed in producing a warranted explanation while leaving its contributors in markedly different positions. A teacher may retain an instrument and the authority to validate measurements; a student may originate a relevant problem and perform a substantial share of the investigation; a local practitioner may make possible an interpretation unavailable through the school curriculum alone; and a publisher or institutional repository may determine how the resulting material becomes publicly legible. The participants' contributions are heterogeneous. They may differ in kind, visibility, duration, and degree of replaceability. A differentiated account of contributions can describe the distinctive intellectual and material roles through which the inquiry developed. Assessment of those roles still calls for explanations of whose work receives acknowledgment, whose knowledge undergoes scrutiny, and whose consent or authorization governs subsequent circulation.

Recognition has three related senses in this framework: *interpretive recognition* concerns whether a contribution is understood, *epistemic recognition* concerns its treatment as possible evidence or criticism, and *institutional recognition* concerns attribution and influence over subsequent decisions. An educator can acknowledge a contribution while retaining authority over its circulation. The distinctions help locate the specific kind of recognition at issue.

Miranda Fricker's account of *epistemic injustice* offers one influential vocabulary for examining wrongs experienced by persons in their capacities as knowers. Her central distinctions concern prejudice-linked credibility deficits in testimonial exchange and unfair disadvantages arising from gaps in collective interpretive resources [25]. Educational interpretation therefore calls for evidence of the relevant credibility judgment or structural interpretive disadvantage. The educational application requires attention to particular mechanisms. A student may describe a regularity observed through care work, migration,

domestic repair, or neighborhood experience, yet encounter a presumption that the description has little evidential standing because of the student's age, language, status, or social location. A second student may have difficulty expressing a valuable distinction because the sanctioned vocabulary of assessment has limited resources for describing it. These possibilities direct analysis toward the specific classroom and institutional practices through which credibility judgments are formed.

The epistemic significance of being heard also depends upon how reception is organized. Dotson's account examines testimonial silencing from oppressed social positions, with particular attention to speaker vulnerability and pernicious ignorance in the reception of testimony [19]. For educational inquiry, this account motivates a context-sensitive examination of reception: a teacher may invite testimony while controlling its permitted form, setting an impractically short response interval, or requesting information whose disclosure carries personal risks. Formal permission to speak can therefore coexist with weak practical possibilities for making an intelligible contribution. Conversely, an educator's refusal to circulate an identifiable disclosure may protect the learner from predictable harm. Evaluating the practice requires attention to the relation among the student's purposes, available modes of expression, institutional responsibilities, and the consequences of disclosure. Recognition includes the conditions of reception as well as the visible act of listening.

The distinction between reception and consequential response is especially clear in discussions of student voice. Cook-Sather examines efforts to reposition students in educational research and reform, including differences among listening, respect, and opportunities to shape educational arrangements [15]. Mitra's situated research on student-voice initiatives links reported developmental possibilities to the organization of adult-student relations, while leaving the scope of the empirical findings within the relevant institutional contexts [38]. These contributions make an important comparison available for generative invitation. A learner may be consulted about a lesson while the curriculum, evidential criteria, public narrative, and intended uses of the resulting work are decided elsewhere. Consultation may provide valuable information and a legitimate channel for expression. The more demanding question is whether the response to that information can alter decisions that matter to the inquiry.

Consequential participation concerns whether a person's contribution can affect questions, interpretation, representation, or subsequent decisions. It extends beyond an opportunity to speak, while remaining subject to justified educational and protective constraints.

Institutions shape which questions receive time, which evidence counts in assessment, who can use resources, and how results are published or retained. These powers bear directly on whose contribution becomes visible and what uses remain available to its authors.

Such authority can protect learners through safety rules, fair assessment, privacy safeguards, and evidential review. Its legitimacy depends on transparent reasons, proportionate constraints, and accessible means of challenge.

Institutional control also changes over the life of an inquiry. A school may authorize the initial question, a teacher the methods used in the classroom, a collaborating organization the conditions of access to its records, and a platform provider the technical arrangements for storage or export. These decisions can remain distributed after students have completed their assessed work. Understanding recognition consequently requires attention to decision points and their relevant authorities: permission to record, the correction of a public claim, attribution, custody of materials, the duration of access, and authorization of secondary uses. These powers need careful differentiation. A contributor's justified request to correct the representation of their testimony has a different basis from an institutional duty to reject a scientifically unsupported inference, and both differ from the statutory rules governing data retention.

Recognition may concern an intellectual or practical *contribution*, a shared *product*, or a *condition of production* such as equipment access and organizational labor. Describing these separately helps avoid equating public visibility with intellectual importance.

Ownership collects distinct questions: authorship, acknowledgment, data custody, recording consent, reproduction rights, reuse permission, and authority to represent a community. Their answers depend on applicable law, institutional rules, ethical commitments, and participants' agreements. Philosophical recognition alone cannot determine legal entitlements.

A contribution may be *appropriated* when its account or practical knowledge is circulated under conditions that disregard the purposes, permissions, or continuing interests of its contributors. Assessing the charge requires context: who consented, how the work was represented, which obligations apply, and who can challenge reuse.

Some educational contexts have additional, historically specific conditions. Indigenous data governance brings historically grounded questions of collective authority and responsibility into decisions about the appropriate scope of circulation. The CARE Principles for Indigenous Data Governance foreground collective benefit, authority to control, responsibility, and ethics in relation to Indigenous data and the rights and interests at stake in their use [12]. These principles emerge from Indigenous sovereignty and data-governance movements and call for attention to the authority, history, and protocols of the particular communities concerned. Tuck and Yang further caution against converting decolonization into a metaphor for unrelated improvements in education, because the term's political and material commitments concern Indigenous land and life [61]. In the present analysis, generative invitation must be interpreted alongside the specific collective authorities, histories, and normative vocabularies that govern a particular inquiry.

Access and disclosure involve different goods. Publication can support scrutiny and reuse, while identifiable accounts or sensitive sites may require restricted circulation. A justified arrangement should specify what can be disclosed, to whom, for which purposes, and under whose authority.

Return concerns the continuing relationship between contributors and an educational result. A learner's question can reshape teaching, while disciplinary methods reshape the learner's inquiry; the resulting knowledge may circulate through institutions and communities. The relevant issue is what access, influence, and future investigative capacities remain available to contributors.

Definition 10.1 (Return of educationally generated knowledge). For a specified educational inquiry, *return of educationally generated knowledge* denotes a situated arrangement through which people who contributed to its production can, to an appropriately justified degree, (i) recognize and access relevant outcomes in usable forms, (ii) influence or contest consequential decisions about their representation and circulation, and (iii) retain or develop capacities and conditions for further inquiry. The arrangement may differentiate responsibilities, permissions, and benefits according to the participants, kinds of contribution, risks, and institutional obligations. The definition supplies a provisional philosophical criterion for evaluating arrangements; empirical measures and legal entitlements require their own methods and authorities.

Definition 10.1 separates *epistemic access* to the account and its evidential basis, *consequential participation* in attribution or dissemination decisions, and *generative continuity* through opportunities for further inquiry. These dimensions may warrant different arrangements, including accessible summaries, controlled datasets, or continued access to relevant methods and collaborators. Their normative standing should be assessed separately from measured learning outcomes.

Community-based participatory research supplies a relevant, although institutionally distinct, comparison. Israel and colleagues review approaches that involve community members and organizational representatives across the research process and seek to connect knowledge development with action relevant to participants' concerns [32]. Educational inquiry may share the challenge of arranging reciprocal expertise and consequential participation, while school attendance requirements, age-related responsibilities, learning aims, and assessment pressures give classroom work distinctive conditions. A community research partnership offers a comparative perspective whose classroom application requires attention to the distinct responsibilities and aims of educational institutions. Its significance here lies in making knowledge circulation an integral question of educational design.

Fair recognition also concerns uneven forms of participation. A student who frames a decisive question, another who performs extensive measurements, and a third who identifies a privacy risk may contribute in distinct ways. Attribution should be responsive to their roles and the purposes of the resulting product.

Credit for guided work may be distributed among learners, educators, and community collaborators. A learner may supply a significant question, a teacher the disciplinary method, and a practitioner

a necessary correction. The resulting attribution and permission arrangements call for context-specific justification.

A constructed case can clarify the interaction of recognition, authority, and return. Consider a secondary-school group investigating changes in an urban stream. Students develop questions about recurring flooding near a route used by local residents. The class combines public rainfall observations, careful site measurements, drawings of drainage features, and voluntary recollections from people living nearby. A teacher assists with units, measurement uncertainty, and the distinction between observed association and a causal explanation. A local association offers historical photographs while making clear that some images contain identifiable persons and property. A university collaborator provides a simple mapping tool. The following scenario is constructed for philosophical comparison and carries the evidential status of an illustrative case.

The first stage of the case concerns the formation of the problem. One student proposes that recent paving has altered runoff, while another notes that flooding reports may also reflect changes in residents' attention or the times they travel. A resident points to drainage maintenance, which the initial lesson had omitted. Students and teacher agree to compare available observations while keeping the explanations provisional. The learner's question and the resident's observation enter the inquiry as relevant contributions, while causal explanations remain subject to testing. The university collaborator's model can help organize measurements but also constrains what appears on the resulting map. The class thus encounters the difference between making a phenomenon legible within an available representation and establishing which features are important to the inquiry.

The second stage concerns a decision about publication. The school proposes a public web map of the investigation and identifies the class as its author. The map includes a rainfall chart, a schematic of drainage, and photographs contributed by residents. Some participants welcome publication; another worries that a location-specific annotation could reveal who reported a disputed property concern. A student also finds that the draft text attributes an interpretation to the class that only a minority had endorsed. These objections require distinct responses. The evidential disagreement calls for clarification of uncertainty and alternative accounts. The privacy concern calls for appropriate restriction or transformation of the displayed information. The attribution concern calls for a process through which contributors can examine and correct a representation of their own positions. Their different grounds of legitimacy call for separate assessment of evidence, protection of participants, and faithful attribution.

Publication decisions in the stream-mapping case include immediate release, a de-identified public version with a restricted detailed record, or delayed release pending further consultation. Each option trades accessibility against privacy, verification, and contributors' control. The educational question includes who can participate in and challenge the choice.

After the project, return may involve accessible explanations, controlled access to data, and permissions for participants to pursue related questions. If records remain usable only within an expired school account, publicly announcing results may leave contributors with limited practical access.

Technical partners may have indispensable roles in co-creation while seeking wider reuse rights; community contributors may seek control over public representations. These claims require differentiated assessment under relevant ethical, institutional, and legal rules.

Digital educational technologies introduce another institutional layer. Learning platforms, analytics tools, automated feedback, and AI-assisted writing or analysis can transform student activity into traces, classifications, and derivative representations used beyond the immediate classroom. Slade and Prinsloo's discussion of ethical issues in learning analytics examines the assumption that institutional knowledge of learners' behavior is necessarily aligned with learner benefit [57]. Within the present framework, the critical questions concern what is recorded, which inferences can be justified, who can inspect or dispute those inferences, and what secondary uses are permitted. An automated summary of a student's educational trajectory may be useful to a teacher while still being contestable by the student whose work it represents. The summary's authority depends on identifiable methods, justified interpretations, and accountable institutional decisions about its use.

Digital circulation can detach questions, annotations, or observations from the circumstances of their

production. When contributions enter institutional datasets or AI-assisted products, attribution, permitted reuse, data protection, and continuing access require explicit arrangements.

Shared authority must accommodate legitimate disagreement, public duties, time constraints, and differing interests among learners, families, educators, and collaborators. Effective participation requires clearly allocated decisions and justified procedures for resolving disputes.

Consultation also has costs. Reviewing materials, attending meetings, or translating a technical report can burden contributors unevenly; accessible formats and proportionate opportunities help distribute those costs more fairly.

A return arrangement should be assessed for its practical accessibility as well as its formal permissions. A technically open repository may demand specialist software or credentials that contributors lack; a consultation meeting may exclude participants whose work or care obligations limit their attendance. Usable summaries, agreed contact points for correction, accessible record formats, and supported opportunities to ask further questions can make participation more consequential. These measures still require consent-sensitive decisions about personal information and community-held materials. The appropriate arrangement is negotiated within a particular institutional and legal setting, with the contribution of affected participants made intelligible in the decision record.

The philosophical account can now specify several provisional criteria for evaluating the institutional fate of educationally produced knowledge. *Contribution legibility* asks whether the relevant kinds of intellectual and material contribution can be described and contested without reducing them to a single rank. *Epistemic accountability* asks whether claims, attributions, and representations remain open to warranted correction under standards appropriate to their content. *Circulation legitimacy* asks whether permission, privacy, community authority, and public interests are considered within the applicable context. *Return accessibility* asks whether contributors can understand or use relevant outcomes in forms suited to their circumstances. *Generative continuity* asks whether opportunities and capacities for further inquiry are sustained or altered. These provisional dimensions organize interpretation and would require further methodological and normative development for use in evaluation.

The proposed dimensions can conflict. Data restrictions may protect participants while limiting reproducibility; extensive consultation may strengthen legitimacy while delaying inquiry. Evaluation should identify these tradeoffs and the reasons supporting decisions.

Generative invitation connects recognition and governance to the trajectory of an educational offering: which contributions enter the inquiry, who can revise its results, and what resources remain available for subsequent work. Established accounts of epistemic justice, student voice, and participatory research provide important comparative frameworks.

The proposal could be examined through decision records, successive versions of artifacts, responses to challenges, participants' accounts of consent and refusal, and later access to resources. Such evidence would help distinguish ceremonial acknowledgment from consequential participation and sustained inquiry.

Recognition and return concern the continuing conditions of educational knowledge. Attribution, access, influence, and further investigative capacities require different forms of evidence and governance. Section 11 compares the explanatory role of these distinctions across educational accounts.

11 Comparative Explanations and Criteria of Educational Transformation

A comparative account of educational transformation should distinguish successful task performance, warranted understanding, initiative over inquiry, continuity of developed capacities, and consequential participation in decisions. This section tests whether *generative invitation* helps interpret differences among these achievements. A common constructed case, rival pedagogical explanations, and a provisional set of research criteria provide the method. The analysis considers how educational trajectories might be documented, what would count as evidence for developmental persistence, and how artificial

assistance complicates attribution. The case establishes an analytical contrast; empirical work would be needed to assess the frequency, mechanisms, and consequences of the differences identified.

A recurrent difficulty in educational comparison is the ease with which different achievements are placed under a single label. Completion of a task may show that a learner has followed a useful procedure. Explanation of a result may reveal conceptual understanding under the conditions of the task. The learner's subsequent formulation of a related question may reveal a further capacity to direct inquiry. An opportunity to join a community investigation may also reflect expanded institutional access, independently of changes in cognitive capacity. The achievements are related, yet their evidence differs. An account that equates them would risk granting generative invitation explanatory success whenever students display enthusiasm, reproduce disciplinary vocabulary, or receive praise for a finished artifact. The present comparison therefore separates *task performance*, *epistemic warrant*, *initiative and revision*, *continuity across settings*, and *participatory consequence*. These dimensions provide a provisional interpretive framework, with operational definitions and measurement properties left for future research.

Existing pedagogical theories supply substantial alternative explanations. A sociocultural account may explain growth through participation in an established practice; scaffolding theory may locate improvement in contingent assistance and changing responsibility; problem-posing education may emphasize dialogue and the political conditions of inquiry; productive disciplinary engagement may emphasize authority, accountability, and access to resources; and design-based research may study how learning opportunities arise through the iterative construction of environments [35, 44, 24, 21, 60]. Generative invitation should therefore earn its place as a discriminating analytical relation. Evaluating its distinctiveness requires comparisons that established traditions could also explain. The central comparison asks whether documenting the offering, its uptake, its transformation, and later access to its results yields additional explanatory or practical discrimination after Deweyan inquiry, Freirean dialogue, and the established engagement frameworks have been applied to the same records.

A particularly demanding comparison concerns *connective and productive disciplinary engagement* (CPDE). Agarwal and Sengupta-Irving extend productive disciplinary engagement by attending to epistemic diversity, learners' histories and identities, and the operation of power within disciplinary learning [1]. These concerns overlap substantially with the present treatment of historically situated repertoires and recognition. The authors examine prior classroom cases of insect metamorphosis and mathematical measurement, using learners' histories and disciplinary questions to investigate the conditions of their participation. More recent scholarship further develops productive disciplinary engagement and expansive framing in relation to situated motivation, learner authorship, identity, belonging, and power [29]. These accounts deserve full consideration when interpreting participation across educational settings. Their framework therefore already encompasses developing inquiry and the politics of whose knowledge counts. Expansive framing provides a further comparison. Engle, Nguyen, and Mendelson conceptualize learning contexts as opportunities to contribute to wider conversations across times, places, and people; their tutoring experiment found greater transfer of several kinds of knowledge under expansive framing than under the bounded comparison condition [22]. Their study therefore already addresses cross-context continuity and the learner's position as a contributor. Its evidence concerns a specific experimental learning ecology and transfer tasks. The proposed focus of generative invitation is an explicitly staged examination of the offered possibility, its consequential uptake, and the later custody, access, and reuse arrangements surrounding the resulting inquiry records. The added governance questions concern who can inspect, correct, preserve, or appropriately restrict educational records after a particular activity, and the conditions through which such arrangements support further inquiry. The comparative question is whether this sequence yields additional, reproducible analytical distinctions concerning educational continuation and record governance when both frameworks examine the same evidence. A CPDE-informed investigation may recover these relations with similar clarity; comparative coding and practical design judgments provide ways to test the proposed incremental value.

The comparisons employ a common procedure. First, the intended disciplinary object is held approximately stable across alternative instructional arrangements. Second, the authority to formulate questions, select methods, interpret anomalies, and revise public representations is varied. Third, the relevant forms

of evidence are distinguished from the visible completion of the assigned task. Fourth, competing interpretations are retained wherever the constructed case leaves the mechanism underdetermined. This procedure resembles a conceptual contrast among possible arrangements; it lacks the controls and observations of a causal experiment. Material differences, teacher expertise, prior experience, peer networks, and institutional policy would have to be measured or examined in any actual study.

The shared comparison focuses on a multilingual public-history project in which students, teachers, and local contributors prepare an exhibition about a neighborhood market. An initial arrangement offers interviews and photographs under categories prepared by the school; another gives participants authority to question translations, reconsider those categories, and negotiate corrections with contributors. Both arrangements may produce competent archival work. The comparison asks what the participants can investigate, which corrections can affect the final account, and whether records remain usable under agreed permissions after assessment. Situated participation and scaffolding can already illuminate aspects of guidance and developing competence [35, 64]. The staged account can be assessed by examining whether it supports further warranted distinctions concerning the encounter and the later custody, accessibility, and appropriate reuse of its records.

Consider a possible sequence within this project. A teacher offers photographs and interviews for an exhibition about a neighborhood market. A student notices that an interviewee's expression of uncertainty has become an affirmative statement in the draft caption; the student brings the original recording, invites a contributor's clarification, and proposes a revised translation. The group checks the recording and the relevant public documents, then changes the caption under agreed consent conditions. After the exhibition, a new group seeks to investigate another period of the market's history. The school can either preserve the usable, permission-governed record or close access when the assessed project ends. The episode is constructed; the alternative arrangements isolate questions that an empirical investigation could document. Access and withdrawal procedures matter to contributors as well as students; their normative stakes are examined in Section 10.

Productive disciplinary engagement (PDE) would direct attention to the students' problematization of the translation, their authority to investigate it, their accountability to evidence and one another, their access to relevant resources, and the development of more sophisticated disciplinary claims through sustained discussion [21]. *Connective and productive disciplinary engagement* (CPDE) offers additional resources for interpreting the student's linguistic history, the recognition of the interviewee's testimony, and the distribution of power over what counts as an admissible correction [1]. *Knowledge building* would examine how participants improve a shared account and sustain collective knowledge through accessible artifacts and discourse [54]. Each approach can give a substantial account of the same episode. Expansive-framing research additionally addresses connections with future settings and positions learners as contributors to wider conversations [22]. The explanatory reach of all these approaches deserves consideration in any argument about the proposed concept's distinctiveness.

The present account offers a more explicitly staged description: an *offering* supplies the materials and permissions; *uptake* begins when a participant treats the translation discrepancy as investigable; *transformation* occurs through justified revision of the public claim; and *continuation* concerns the subsequent availability of records, correction procedures, and opportunities for further inquiry. This sequence is useful only insofar as identifying the stages changes the evidence collected, the interpretation of a difficult case, or a justified educational decision. For example, accurate correction of the caption could coexist with the later loss of the permitted source record; durable record access could coexist with little evidence that the learner developed independent source criticism. These are distinct outcomes. Table 1 presents overlapping analytical emphases and supports tests of their relative explanatory utility.

Table 2 organizes the major evidential distinctions. Its categories are proposed prompts for observation and deliberation. Researchers could develop the dimensions into interview protocols, artifact analyses, decision records, or longitudinal observations, with validation and scoring questions addressed during instrument design.

Table 1: Comparison of analytic emphases in the same constructed public-history episode.

Approach	Salient evidence in the shared case	Comparison question
Productive disciplinary engagement	Student problematization, disciplinary accountability, authority, and resources	Do these principles already explain the consequential caption revision?
Connective and productive disciplinary engagement	Language histories, epistemic diversity, and power over whose correction counts	Does a power-sensitive account explain the correction and participants' subsequent opportunities?
Knowledge building	Improvement of a common account, accessible artifacts, and collective inquiry	Does following the evolving shared artifact adequately capture its educational afterlife?
Generative invitation (proposal)	Documented offering, uptake, justified transformation, and conditions for continuation	Does staging the trajectory reveal a relevant difference or decision that the other analyses leave less explicit?

Table 2: Proposed evidential dimensions for comparing educational transformations.

Dimension	Possible evidence	Interpretive caution
Task and conceptual performance	Solutions, explanations, error analysis, justified claims	Achievement may depend on a tightly specified task
Problem agency	Learner-originated questions, design choices, documented revisions	Choice may be nominal or heavily directed
Epistemic accountability	Source tracing, testing, uncertainty, response to counterevidence	Confidence and polished presentation can conceal weak warrant
Continuity and transfer	Later inquiries, new settings, opportunities to use or transform knowledge	New settings differ in resources, recognition, and access
Participatory consequence	Changed decisions, corrected representations, ongoing access and permission	Visible participation may coexist with unequal power

The distinction between performance and durable transformation is particularly important. Learning research has long confronted difficulties in defining and measuring transfer. Barnett and Ceci argue that judgments about transfer vary with multiple dimensions of the relationship between learning and later application; their taxonomy challenges undifferentiated claims that a capacity has transferred across contexts [6]. Bransford and Schwartz propose assessing preparation for future learning in knowledge-rich settings where learners can use resources, feedback, and further opportunities to learn [11]. This prior account gives substantive attention to continued learning. The proposed framework therefore invites a specific comparison concerning the educational offering and the institutional availability of later opportunities. These arguments are compatible with, yet independent from, the generative-invitation proposal. The present analysis similarly treats a successful response to a familiar task as evidence within a bounded setting and asks whether subsequent environments permit and elicit further inquiry. It treats later achievements as potentially dependent on multiple interactions, resources, and opportunities.

A workable evaluation of continuity would follow particular questions, practices, and relations through time. In a later public-history project, the learner might encounter another disputed translation and independently propose a method for checking recordings, contextual sources, and contributors' permissions. Relevant evidence would include the learner's choice of investigative procedure, explanation of uncertainty, attention to relevant consent conditions, and ability to seek appropriate assistance. A correct correction in the initial exhibition supports a bounded conclusion; later justified source criticism provides evidence of a different achievement. The interpretation depends on opportunities for participation and the standards of warranted reasoning in the new setting.

There is also a sociocultural complication. Later opportunities arise within new institutions and relationships. Beach's discussion of consequential transitions provides an alternative to treating development

solely as the transport of an internal skill between stable locations [7]. The National Academies' synthesis likewise emphasizes learning as situated within interacting cultural, social, developmental, and environmental contexts [41]. A learner may acquire a capacity in one classroom and find that a later institution gives little opportunity to exercise it. Another may appear newly competent because a mentor, workplace, or community now offers materials and recognition previously unavailable. These examples caution against interpreting changes in performance exclusively as changes in an individual's internal repertoire. Longitudinal comparison should track both developed capacities and the conditions of their exercise.

Persistence presents a related problem. An impressive classroom project may coincide with temporary enthusiasm, an unusually attentive instructor, access to specialist equipment, or a public showcase. Its influence on later inquiry may dissipate when those supports end. Such dissipation may coexist with worthwhile initial learning while limiting conclusions about durable investigative capacities. Conversely, a later independent investigation may draw on several accumulated experiences, including participation in family practices, peer networks, and subsequent courses. Attribution to a single instructional episode would then require particular caution. The proposed account permits a relational understanding of persistence: a capacity may remain available through supportive people, materials, institutional rules, and habits of inquiry, even when its visible expression changes across settings.

A comparison should accordingly distinguish at least three temporal questions. The *immediate question* concerns what became possible during the offered activity. The *developmental question* concerns which practices and capacities remained accessible through subsequent opportunities. The *institutional question* concerns which arrangements preserved, restricted, or redirected those opportunities over a longer interval. None of these timescales is privileged by definition. An urgent safety lesson may be appropriately judged by prompt and accurate performance; a research apprenticeship may call for later problem formulation; a partnership with community contributors may be evaluated partly through continuing access, correction, and stewardship. The adequacy of the evaluative interval follows from the purposes and obligations of the particular educational relation.

These distinctions suggest a research design that could test whether generative invitation identifies a mechanism with distinctive explanatory utility. An initial stage would document the planned offering and the actual enactment: lesson materials, available resources, teacher interventions, learner interpretations, and institutional constraints. A second stage would trace the provenance and development of significant questions. Investigators could examine successive plans, field notes, recordings collected under appropriate consent, drafts, and artifacts for moments when a learner's proposal materially changed the direction of inquiry. A third stage would analyze epistemic warrant through the treatment of uncertainty, counterevidence, and criticism. A fourth would examine opportunities to pursue inquiries in altered contexts after the original activity. A fifth would consider who could access, correct, attribute, or withhold the resulting knowledge. Each stage addresses a distinct claim and requires evidence appropriate to it.

Design-based research provides a pertinent methodological comparison. The Design-Based Research Collective describes a reciprocal relation between the design of learning environments and the development of theory, with attention to enactment in authentic settings [60]. Penuel and colleagues extend the discussion through design-based implementation research, emphasizing persistent problems of practice, collaborative design, inquiry into learning and implementation, and sustained institutional capacity [43]. The present proposal could be investigated through such approaches, provided its interpretation remains open to unfavorable outcomes. An intervention advertised as generative invitation might yield little change in learner problem agency, generate inaccessible research artifacts, or transfer responsibility before learners have adequate support. Those outcomes would count against the quality or scope of the relevant implementation, and repeated failures under apparently favorable conditions would challenge the broader mechanism proposed here.

The comparative analysis also examines alternative causal accounts. Improvements in explanation may follow directly from increased time with materials or explicit instruction. Increased question-asking may reflect familiarity with the teacher's preferences. Later project participation may reflect access to a prestigious program, a durable change in independent inquiry, or their combination. A group's appar-

ent empowerment may result from one participant's social standing. A successful public artifact may depend on an experienced editor who substantially reorganizes the learners' material. Such accounts are plausible within the kinds of constructed cases considered here. Future research should specify comparison conditions prospectively, record differences in prior experience and resources, and use transparent interpretations of disagreement among observers. Where quantitative designs are feasible, outcomes should be defined independently of whether the intervention bears the preferred conceptual label. Where small-scale ethnographic or historical inquiry is more appropriate, researchers should make visible the evidential route from observations to interpretations.

Comparative evidence can also be *within-case*. A learner may accept an initial problem, find that a familiar technique fails, encounter corrective guidance, and reformulate the question with greater precision. These stages can be distinguished in the evolving artifact and the reasons participants give for their decisions. The central inquiry concerns whether the transformation is causally plausible and how it relates to existing forms of assistance and participation. A change in question wording is an initial indicator that calls for interpretation alongside subsequent actions. A learner may repeat an instructor's formulation with limited understanding, whereas a quieter learner may exercise substantial agency through experiment design, careful observation, or restraint in drawing conclusions. Observation and interpretation should therefore include multiple modes of participation. The analytic framework is meant to make salient possibilities that a purely verbal measure of classroom initiative could overlook.

The shared case also permits a prospective comparison of rival analyses. Before reviewing outcomes, investigators could specify records of the original offering, students' subsequent decisions, the evidential basis of the revised caption, and access conditions after assessment. They could then ask analysts using PDE, CPDE, knowledge building, and generative invitation to code the same sequence independently and propose interventions from their respective interpretations. A consequential difference would arise if one analysis reliably identified a restriction or educational possibility that others overlooked, with independently assessable grounds for acting on it. Agreement in codes, recommendations, and warranted explanations would support the more economical established account. This proposed comparison is a methodological design requiring validation of the coding procedure and attention to analysts' expertise; it supplies no empirical result.

The proposed comparison should retain a separation between three kinds of judgment. Descriptive coders identify observable actions and available permissions; educational evaluators examine the reasons and learning evidence associated with those actions; participants and responsible authorities assess the legitimacy of disclosure and subsequent use. These judgments may inform one another while remaining answerable to different standards. For example, access to an interview can be well documented while its wider publication remains ethically restricted, and a corrected caption can be epistemically sound while the learner's lasting capacity for source criticism remains uncertain. An analysis gains discriminating value by preserving these differences, identifying the evidence relevant to each, and making an additional educational decision defensible. The same standard should apply to established frameworks in the comparison.

A demanding test of the concept would consider unfavorable cases as well as successful ones. A highly directive lesson may establish durable independent reasoning when learners later reconstruct and extend its method. A dialogical activity may be enjoyable while offering little epistemic challenge. An invitation may reproduce unequal participation when it presupposes familiarity with particular tools or norms of public speech. Learner-selected topics may also carry risks requiring more stringent teacher intervention. These possibilities prevent a ranking of pedagogies based solely on formal openness. They suggest that the ethically relevant object of evaluation is a situated relation among possibilities, warranted standards, capacities, and responsibilities. The concept of generative invitation is intended to describe the relations through which an educational offering becomes available for consequential learner inquiry.

Artificial tools introduce a further comparative problem. Suppose learners in a programming class are offered access to an AI system that can propose explanations, generate code, revise prose, and suggest tests. In one arrangement, the tool supplies a complete solution to a teacher-specified problem. The learner verifies that the program runs and submits it with the required acknowledgment. In another,

students begin with an ambiguous practical requirement, use the system to propose alternative interpretations, inspect the assumptions of generated code, design independent tests, and revise the statement of the problem in response to failures. The second arrangement may afford more opportunities for problem formation. Yet the visible richness of the interaction may also arise from the tool's capacity to generate persuasive questions and polished explanations with limited learner comprehension.

The distinction calls for careful attribution of contributions and evidence. A generated set of test cases may expand the learner's access to examples; it may also conceal the source of a decisive insight. A learner's ability to explain the program, identify erroneous assumptions, devise a new test without assistance, and evaluate uncertainty under changed conditions would be more discriminating than output complexity alone. Even these observations require an account of permissible tool use and comparable learning opportunities. UNESCO's guidance by Miao and Holmes emphasizes human-centred educational design, privacy protection, and appropriate ethical validation and governance of generative AI [37]. This policy guidance identifies relevant design and governance concerns; the effectiveness of particular AI-mediated practices remains an empirical question. The conceptual framework developed here makes the further proposal that institutional arrangements should preserve intelligible possibilities for learners to contest, redirect, and critically assess artificial contributions.

Artificial assistance also complicates the phrase *learner's own inquiry*. Ownership of a question can concern the learner's practical commitment, understanding, and responsibility for subsequent decisions even when its formulation involves other people or tools. A student may critically adopt a suggestion originally offered by a teacher or machine and make it consequential through justified revisions. A student may also compose an original-looking prompt while pursuing an externally prescribed agenda over which they have little authority. An investigation of learner agency should therefore follow the trajectory of interpretation and decision, acknowledging heterogeneous sources of intellectual support. Questions concerning artificial subjectivity remain open; the present assessment focuses on the educational practices and responsibilities of the people and institutions using these systems. Its present purpose is to examine educational evidence and responsibility within a specific institutional activity.

Ethical assessment forms part of methodological evaluation. Consent to an educational study should be intelligible within the participants' circumstances and protected from coercion associated with grading or institutional authority. Reporting should avoid identifying sensitive contributors merely because public attribution is valued. Researchers should document who sets the questions and controls the records, what participants can reasonably decline, and how legitimate community-specific obligations affect circulation. A proposal to compare invitations with more directive instruction would require attention to fairness and to the educational benefits reasonably owed to participants across study conditions. These obligations retain their force throughout philosophical and empirical investigation. Evaluation of an educational artifact should be accompanied by assessment of research legitimacy and the distribution of its benefits and burdens.

The interpretation of evidence further requires distinguishing failures of an instructional design from failures of the theoretical concept. Where usable instruments are inaccessible, limited subsequent inquiry may reflect constraints on opportunity as well as the learner's developing capacities. An empirical study can specify observable conditions of implementation in advance, allowing unexpected or disappointing results to inform revision of the proposal. Examples might include evidence that participants could understand the initial offering, exercise consequential choice over an epistemically relevant aspect, receive accountable guidance, and revise a claim or method without arbitrary penalty. These conditions are provisional and contestable. They should be stated early enough to prevent retrospective adjustment solely to preserve the hypothesis.

Variation among educational settings also shapes the framework's domain of application. What constitutes an intelligible invitation varies with language, disability, developmental history, prior experience, and the institutional environment. Public verbal participation may be a poor indicator of agency for learners who reason principally through material manipulation, drawing, movement, or delayed reflection. Access to a tool can expand opportunity while conceptual understanding follows its own developmental trajectory. Community participation may be warranted even where the purposes of school assessment and

public knowledge production remain partially incompatible. The educational researcher needs enough local interpretation to respect these differences, together with sufficiently stable distinctions to make comparison possible. Comparative ambition should therefore be accompanied by an account of which features travel across cases and which require local specification.

The proposal consequently faces three progressively demanding tests. A *descriptive test* assesses whether independent readers can identify offering, uptake, transformation, and continuation from records with adequate consistency, including ambiguous episodes. A *practical test* examines whether the staged account supports an educational or governance decision that participants can justify and that alternative accounts would assess differently. An *explanatory test* investigates whether the recorded trajectory improves understanding of later inquiry after accounting for prior achievement, guidance, resources, participation, and selection effects. The categories should be specified before an intervention or archival comparison, and success should be judged independently of the preferred theoretical label. Equivalent performance by established accounts would favor conceptual economy; greater discrimination by the proposed account would justify further development. These possibilities remain open research outcomes.

The comparison supports an account of educational transformation with distinguishable dimensions: task performance, explanatory warrant, authority over questions, transfer of capacities, and participation in knowledge governance. Their relations may vary across settings and over time. Constructed cases clarify the differences; observation, longitudinal evidence, and explicit rival explanations would be needed to investigate their causal significance. Generative invitation can be assessed for its descriptive clarity, practical discrimination, and incremental explanatory value alongside scaffolding, situated participation, and problem-posing accounts. These methodological criteria bring the argument to its concluding questions about interpretation, institutional responsibility, and future inquiry.

12 Conclusions and Open Philosophical Problems

Teaching through the learner's generative language concerns the relation between historically developed resources, educational offerings, and the learner's subsequent possibilities for inquiry. The paper has developed this relation through six connected problems: interpretation of learner repertoires, pedagogical invitation, partial translation, warranted knowledge formation, responsible guidance, and the institutional life of the knowledge produced. These distinctions form a provisional comparative framework for educational philosophy and research.

A *learner's generative language* is the changing repertoire of signs, techniques, embodied skills, practical expectations, and relationships through which inquiry becomes possible. Its relevant boundaries depend on the educational situation and the histories of participation that make particular resources available. Classroom artifacts, practical activity, learner testimony, and collaborative interpretation can help educators investigate this repertoire. Any resulting description remains open to correction by the learner's further activity and by the constraints of the setting. This approach gives educational interpretation a historically situated object while retaining a revisable understanding of individual and collective capacities.

A *generative invitation* concerns an intelligible offering with substantive opportunities for the learner to develop and revise an inquiry. Such an offering can be a question, instrument, representation, text, encounter, or cooperative arrangement. Its educational significance depends on the possibilities available for uptake, disciplined transformation, and continuation. A carefully structured lesson may support these possibilities; an ostensibly open activity may leave consequential decisions predetermined. The distinction among the offering, the learner's actual uptake, and later outcomes therefore anchors the proposal's comparative use. It allows an invitation to be described and evaluated even where the anticipated learning trajectory develops differently from the teacher's expectation.

Partial translation describes coordination among pedagogical and learner practices with partly divergent meanings, standards, and histories. Translation can support shared inquiry through intelligible correspondences, responsible use of evidence, and revision of interpretations. It also carries questions of permission and interpretive authority. A teacher may understand enough of a community practice to de-

velop a productive lesson while respecting aspects of that practice that remain private or locally governed. Educational understanding consequently grows through negotiated access and situated accountability.

The account of *knowledge formation* connects problem agency with epistemic warrant. Learners can develop questions, adapt methods, interpret anomalies, and defend conclusions through activity shared with teachers, peers, communities, and technical systems. Evidence for these achievements varies. A correct result supports one kind of claim; justified explanation supports another; later initiative across settings may reveal continuing investigative capacity. The comparative dimensions developed in Section 11 distinguish performance, understanding, consequential revision, continuation, and participation in decisions about knowledge. Their relevance depends on the educational purpose being assessed.

Guidance and autonomy enter this framework through differentiated responsibilities. Teachers provide disciplinary resources, appropriate correction, equitable access, and protections connected with practical risk. Learners may exercise judgment over questions and methods while relying on assistance for other activities. Progress in one responsibility can coexist with continuing dependence in another. A responsible pedagogical relation makes these allocations intelligible and open to justified revision, including the possibility that a learner's interpretation reveals an overlooked assumption in the initial task.

Finally, the *return of knowledge* concerns the continuing conditions of access, attribution, interpretation, and reuse after an educational activity produces an artifact or public claim. Decisions about publication, privacy, cultural permissions, and benefits can affect learners and collaborating communities long after assessment. Section 10 develops these institutional questions as a normative dimension of educational co-creation. Recognition of contribution and warranted authority over its later circulation require attention to distinct interests and obligations.

The proposed concept is situated among established philosophies of experience, mediated development, problem-posing education, and intellectual emancipation [17, 62, 24, 45]. Productive disciplinary engagement, its connective extension, and knowledge building already analyze important aspects of authority, resources, epistemic diversity, and collective inquiry. The present proposal offers a temporally articulated vocabulary for the relation among offering, uptake, transformation, and continued opportunity. Its theoretical value depends on whether that vocabulary permits an interpretable distinction or practical judgment that established accounts explain less economically. Conceptual resemblance alone offers insufficient grounds for a separate theory; comparative analysis should remain open to convergence.

Several philosophical problems remain central. The first concerns *interpretive boundaries*: which resources belong to the relevant learner repertoire, how a teacher's description can be corrected, and how educational inquiry should respect collective or private knowledge. A second concerns *consequential authority*: whether learners can revise questions and evidential standards under conditions shaped by assessment, grading, and unequal institutional resources. A third concerns *warranted correction*: how teachers can protect accuracy and safety while maintaining space for learners to examine disagreement and recognize the grounds of an intervention. Each problem calls for analysis specific to the activity and its participants.

A related question concerns the *duration of educational transformation*. A capacity may be developed without an immediate opportunity for exercise, and later achievement may depend on family experience, mentorship, technologies, or institutional access alongside classroom teaching. Longitudinal observation could follow changes in questions, artifacts, methods, and relationships while attending to this plurality of influences. Research designs should specify in advance which records would support an inference about offering, uptake, and continuation, and which observations would favor alternative explanations. The descriptive, practical, and explanatory tests proposed in Section 11 offer a starting point for this work.

The increasing availability of generative AI introduces further questions of provenance and evaluation. Generated explanations, code, diagrams, and prompts can become resources for learner inquiry, while the same polished artifact can arise through different distributions of understanding and labor. An adequate assessment may examine the learner's explanations, independently chosen tests, responses to error, and capacity to revise a result under changed conditions. Such evidence gathering carries obliga-

tions of accessibility, privacy, and proportionate disclosure. Institutional choices about data retention and reuse belong to the same broader inquiry into responsibility and knowledge circulation.

A further normative question concerns whose opportunities and interests are served by an educational activity. A project may benefit individual learners, strengthen collective capacities, or generate publicly useful knowledge while distributing labor, risk, recognition, and decision-making unevenly. Its educational value therefore invites plural and situated judgment. The framework can support that judgment by identifying who shapes a question, how contributions are assessed, and which possibilities for future inquiry remain available to participants.

Future work can proceed through philosophical clarification, comparative case analysis, and research with learners and collaborating communities. A demanding empirical comparison would apply generative invitation and rival frameworks to the same interaction records, assess agreement among analysts, and examine whether the resulting interpretations lead to meaningfully different educational or governance decisions. Negative and ambiguous cases are especially informative: substantial later initiative after directive teaching, limited learning after an apparently generous invitation, or strong knowledge production under unequal conditions can refine the proposed relations. These observations should be evaluated with care for setting-specific resources and responsibilities.

Generative invitation thus names a proposed way of tracing how educational offerings enter historically situated repertoires and become available for further inquiry. Its strength lies in the clarity with which it can relate interpretive access, epistemic responsibility, learner-directed transformation, and the continuing conditions of knowledge formation. Whether this articulation improves educational understanding will be determined through explicit comparison, practical use, and sustained critical inquiry.

Research Ethics and Source Provenance

Study design. This is a philosophical and comparative study using constructed educational scenarios. It reports no original human-participant data or measured educational effects. The suggested research designs and evaluative criteria remain proposals for future investigation.

Source provenance. Bibliographic and claim-level checks were recorded across the manuscript's twelve sections. Selected passages were additionally compared against original-page sources, including primary works by Dewey, Freire, and Rancière and studies of boundary learning and disciplinary engagement. Evidence tiers vary: some claims have original-page support; others have publisher-record, abstract, or secondary support. Direct original-page inspection of Engle and Conant (2002) remains outstanding; its four design principles are corroborated by publisher information and an independently checked scholarly discussion. The detailed evidence ledger in the companion editable-source archive documents the scope and limitations of these checks. The framework's incremental explanatory value and educational outcomes remain open to independent evaluation.

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