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Who Really Designs? Teacher Agency and Artificial Intelligence: An Exploratory Study

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Abstract: This exploratory study examines how teacher agency is exercised during interaction with a conversational agent for instructional design. We distinguish engagement as observable participation in design decisions from mere frequency or duration of platform use. The available empirical material comprises 19 questionnaire responses collected on 7 May 2026 and a secondary analysis of 144 question–answer exchanges from 7–9 May 2026 (14 user/group identifiers, approximately 18 sessions). Questionnaire responses indicate strong self-reported responsibility for design choices (exploratory agency index M = 3.99/5), alongside more moderate confidence in handling complexity (M = 3.04/5). The documented interaction cases illustrate how a generic topic can be situated through successive constraints and teacher decisions, while also revealing that an agent's questions can pre-structure the choice space. We therefore propose four sensitising interaction modes—extractive, incremental, evaluative, and co-design—without claiming that these have been validated as stable participant types. Rather than inferring that artificial intelligence increases agency, we argue that conversational scaffolding creates opportunities for its situated enactment that must be assessed through observable decisions, critical revisions, and ownership of the final design. Findings remain exploratory given the small self-report sample, the lack of matched pre/post data and the unavailability of raw interaction logs for independent recoding.

Keywords: teacher agency; generative artificial intelligence; instructional design; conversational scaffolding; design engagement.

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1. Framing Teacher Agency in AI-Mediated Instructional Design[1]

Generative artificial intelligence has made the production of instructional artifacts exceptionally fast. Lesson plans, rubrics, learning activities, differentiated materials and assessment prompts can now be generated from minimal natural-language requests. This technical acceleration, however, does not resolve a pedagogical question that precedes the availability of generative systems: designing for learning is not reducible to producing a plausible artifact. Instructional design requires teachers to interpret a situation, formulate educational purposes, make assumptions about learners and contexts, compare alternatives, anticipate

[1] The paper is the result of a joint collaboration between the authors. However, Fabrizio Schiavo wrote the paragraphs 2 and 3; Giuseppina Rita Jose Mangione wrote paragraphs 1 and 4; Pio Alfredo Di Tore wrote paragraph 5.

consequences, align activities with assessment, and take responsibility for the final configuration of a learning environment. The increasing fluency of generative systems therefore makes the distinction between artifact production and professional design more, rather than less, important.

This distinction is particularly consequential for teacher professional learning. Reflective practice is commonly understood as a process through which professional knowledge is reconstructed in and through action rather than simply applied as a fixed body of prescriptions (Schön, 1983). From this perspective, a planning environment becomes educationally relevant when it creates occasions for the teacher to make implicit assumptions explicit, revisit initial framings and articulate reasons for a decision. Teacher education research similarly emphasises the value of connecting theoretical resources, situated experience and inquiry into practice rather than treating professional learning as the linear acquisition of techniques (Zeichner, 2010; Darling-Hammond, Hyler, & Gardner, 2017). The question raised by generative AI is therefore not whether a system can supply pedagogical suggestions, but whether interaction with that system preserves a space in which professional judgement can be enacted and made visible.

FABER was developed within this problem space. It is a pedagogically oriented conversational agent for instructional design, created through collaboration between INDIRE and the University of Cassino and Southern Lazio. In an earlier study, FABER was analysed as an epistemic partner embedded in co-design ateliers and oriented towards reflective, inclusive and sustainability-aware professional learning (Schiavo, Mangione, & Di Tore, 2026). That study focused primarily on the educational architecture of the agent and on broad qualitative transformations observed in teacher–chatbot dialogue. The present study deliberately narrows the analytical focus. Rather than asking whether FABER supports professional learning in general, it asks where pedagogical control can be located in concrete design exchanges and which observable actions are defensible indicators of teacher agency.

The narrower focus responds to a recurrent methodological problem in studies of AI-assisted design. Interaction volume, session length, user satisfaction and the apparent completeness of generated artifacts are easy to measure, but they are weak proxies for reflective engagement. A long interaction may reflect confusion or repeated repair; a brief interaction may contain a decisive reframing. Similarly, answering a sequence of system-generated questions may indicate active specification of a problem, but it may also indicate that the user is simply following a choice architecture defined by the agent. The analytic challenge is consequently to distinguish conversational continuation from pedagogically meaningful intervention.

1.1. Reflective professional learning and instructional design

The study adopts a view of instructional design as professional reasoning rather than as the execution of a procedural template. Laurillard (2012) describes teaching as a design science in which practitioners iteratively build, test and refine pedagogical solutions. Such a perspective is compatible with Schön's (1983) distinction between reflection-in-action and reflection-on-action: teachers encounter

indeterminate situations, respond to them and revise their framing as consequences become visible. In AI-mediated planning, this iterative structure is potentially externalised in dialogue. Requests, clarifications, acceptances, rejections and reformulations leave traces of how the design problem is being constituted.

Dialogue is particularly relevant because professional reasoning is not exclusively intrapersonal. Sociocultural accounts treat language as a tool for thinking together and for progressively constructing shared objects of attention (Mercer, 2000). In a teacher–agent interaction, the conversational record can therefore be read as a partial trace of distributed sense-making. It remains partial because an utterance does not transparently reveal cognition and because professional decisions are also shaped by institutional, curricular and experiential resources that may never be verbalised. This is why the present study treats conversational traces as evidence of actions performed in interaction, not as direct measurements of internal reflective states.

1.2. Teacher agency and AI-mediated co-design

Teacher agency provides a second conceptual anchor. In the ecological model proposed by Priestley, Biesta, and Robinson (2015), agency is not an enduring individual attribute but an achievement emerging from the interaction of personal capacities, temporal orientations and environmental conditions. This matters for generative AI because an agent is not a neutral channel through which an already formed intention passes. Its prompts, defaults, examples, alternatives and sequencing constitute part of the environment in which action becomes possible. An AI system can expand a teacher's repertoire while simultaneously narrowing the field of choices by framing what counts as a relevant alternative.

For this reason, agency cannot be inferred from the simple presence of interaction. More defensible indicators occur when the teacher introduces a constraint that was not supplied by the agent, rejects or modifies a proposed direction, requests justification, changes the educational purpose, or reorders priorities in the emerging design. Conversely, short option selections can have different meanings depending on their sequential position. Selecting "1" after an agent has produced three alternatives may be an efficient micro-decision, but without further evidence it should not be coded as reflective agency. The unit of interpretation must therefore be the sequence and the consequences of a move, not its length or linguistic sophistication alone.

Research on pedagogical conversational agents provides a useful but heterogeneous background. Conversational systems have been used as instructors, companions and scaffolds, with effectiveness depending on pedagogical role, interaction design and the degree to which dialogue supports rather than replaces learner or teacher activity (Pérez-Marín, 2021; Khosravi-Rad, Pérez-Marín, & Corradini, 2022). Relational and conversational qualities can support sustained interaction (Bickmore & Picard, 2005), while generative systems introduce new affordances and risks because their responses are not limited to predefined scripts.

The central design problem is therefore how to combine generativity with pedagogical control and critical verification.

1.3. Teacher professional agency, pedagogical judgement and professional learning

From a pedagogical perspective, teacher agency cannot be understood exclusively as the capacity to make autonomous decisions or to influence the development of instructional artifacts. It is more fundamentally connected to the exercise of professional judgement, through which teachers interpret educational situations, negotiate pedagogical purposes and assume responsibility for their choices. Teaching is not merely a technical activity directed towards the implementation of predefined procedures, but a complex professional practice involving situated interpretations, educational values and decisions whose appropriateness depends on the specific conditions in which learning takes place. As Biesta (2015) argues, professional judgement is inseparable from the question of educational purpose, which cannot be reduced to considerations of efficiency or effectiveness alone. The different purposes of education—qualification, socialisation and subjectification—require teachers to engage in deliberation about what is educationally desirable and appropriate. Within this perspective, teacher agency acquires a specifically pedagogical significance: it concerns not simply the possibility of acting, but the capacity to act in ways that are informed by educational intentions and professional responsibility.

This interpretation is closely related to the nature of teachers' professional knowledge. Shulman (1987) conceptualises teaching as a process of pedagogical reasoning and action in which disciplinary knowledge, pedagogical content knowledge and knowledge of learners and educational contexts contribute to the transformation of subject matter into meaningful learning opportunities. Instructional design can therefore be understood as an expression of professional knowledge in action, rather than the mechanical application of externally produced solutions. Similarly, Kelchtermans (2009) emphasises the importance of teachers' professional self-understanding and subjective educational theories, which constitute a personal interpretative framework through which educational experiences and professional situations acquire meaning. From this perspective, teachers' design decisions are shaped not only by explicit curricular requirements or methodological preferences, but also by the professional meanings, assumptions and commitments developed throughout their careers. The exercise of agency consequently involves the mobilisation of situated professional knowledge and the capacity to critically examine the educational assumptions underlying instructional choices.

The connection between professional knowledge and agency becomes particularly relevant when agency is considered as a situated and relational achievement rather than a stable individual disposition. Eteläpelto, Vähäsantanen, Hökkä, and Paloniemi (2013) conceptualise professional agency through a subject-centred sociocultural perspective, highlighting the interplay between individual professional resources and the social and structural conditions of work. In educational settings, teachers' possibilities for action are shaped by institutional

expectations, available resources, professional relationships and the cultural conditions of schooling. Biesta, Priestley, and Robinson (2015) further demonstrate the relevance of teachers' beliefs and orientations in understanding how agency is achieved within particular educational environments. These contributions suggest that professional agency should not be equated with unrestricted autonomy or individual resistance to external influences. Rather, it involves the capacity to interpret available possibilities, negotiate constraints and make purposeful decisions grounded in professional knowledge and educational values.

A further dimension concerns the relationship between agency and professional learning. From an inquiry-oriented perspective, teachers are not merely recipients of pedagogical knowledge produced elsewhere, but active interpreters and producers of professional knowledge. Cochran-Smith and Lytle (2009), through the concept of *inquiry as stance*, emphasise the importance of systematically questioning educational practices, examining assumptions and constructing knowledge through critical engagement with professional experience. Teacher professional development thus extends beyond the acquisition of techniques and competencies to encompass the continuous reconstruction of pedagogical understanding. Korthagen (2017) similarly underlines the multidimensional nature of teacher learning, highlighting the connections among cognitive, emotional and motivational dimensions and the importance of integrating professional experience with deeper levels of reflection. Within this framework, the development of professional agency can be regarded as a potentially significant dimension of professional learning, particularly when teachers are encouraged to reconsider established interpretations, articulate the reasons for their decisions and explore alternative approaches to educational problems.

The introduction of generative artificial intelligence into instructional design creates new conditions for the exercise of such professional judgement. Conversational agents may provide suggestions, organise information, propose instructional alternatives and support the progressive specification of design problems. However, the availability of generative resources does not eliminate the need for teachers to interpret the educational relevance of proposed solutions. On the contrary, it makes the distinction between the production of an instructional artifact and the exercise of professional pedagogical reasoning particularly important. A technically coherent or apparently complete proposal does not necessarily reflect the complexity of the educational situation, the diversity of learners' needs or the purposes that teachers intend to pursue. Consequently, the pedagogical significance of AI-mediated design depends not only on the system's capacity to generate plausible alternatives, but also on the opportunities available for teachers to examine, justify, question and potentially redefine those alternatives in relation to their professional knowledge and educational intentions.

In this perspective, AI-mediated instructional design can also be considered a potentially relevant context for professional inquiry. The conversational externalisation of design decisions may provide opportunities to make implicit assumptions explicit, compare pedagogical possibilities and reflect on the relationships between educational purposes, contextual constraints and proposed activities. Such processes are consistent with conceptions of teacher professional

learning that emphasise reflective judgement, inquiry and the active reconstruction of professional knowledge. Nevertheless, the presence of these opportunities should not be interpreted as evidence that professional learning has necessarily occurred. Observable decisions and conversational reformulations can reveal situated expressions of agency, whereas claims about its development require further evidence of changes in teachers' professional understanding and practices over time. This distinction provides an important pedagogical foundation for examining FABER-assisted instructional design: the analytical focus is not only on how teachers participate in conversational processes, but also on how their professional knowledge, educational priorities and capacity for judgement become visible through interaction.

1.4. Complexity, sustainability and systems thinking

FABER was originally conceived around a further design challenge: helping teachers work with educational problems that cannot be reduced to isolated variables. Sustainability education requires attention to interdependencies among environmental, social, technological and economic dimensions, and GreenComp explicitly frames sustainability competence in systemic and transformative terms (European Commission, 2022). Systems thinking similarly invites learners and teachers to attend to relationships, feedback, delayed effects and patterns rather than treating complex problems as linear chains of causes (Senge, 1990; Meadows, 2008). Transformative sustainability education consequently demands pedagogies capable of preserving complexity while still making it actionable (Sterling, 2010; Wals, 2015).

This creates a productive tension for conversational scaffolding. Good scaffolding decomposes difficult activity and makes progress possible (Jonassen, 1999), but excessive decomposition can make the problem pedagogically thinner. A system that immediately converts every broad educational problem into a ready-made sequence may increase usability while decreasing opportunities for problem construction. The questionnaire analysed in this study is especially informative in this regard because it distinguishes declared agency from the management of design complexity. The contrast between these dimensions provides contextual evidence for interpreting the interaction cases.

1.5. Aim and research questions

The present study is an exploratory secondary analysis of a May 2026 FABER workshop corpus. Its purpose is not to test the causal effectiveness of the agent. Instead, it investigates how teacher agency can be operationalised conservatively in the available data and how self-reported design orientations contextualise observed interactional moves. Three research questions guide the analysis:

RQ1. Which observable conversational practices are consistent with the situated exercise of teacher agency during FABER-assisted instructional design?

RQ2. How do successive contextual constraints, selections and teacher-initiated reformulations transform the emerging instructional design within documented interaction sequences?

RQ3. Which self-reported orientations toward intentionality, problem framing, revision, alignment, agency, complexity and sustainability provide a baseline for interpreting—but not validating—the conversational evidence?

2. Materials and Methods

2.1. Research design and relation to the previous FABER study

The study adopts an exploratory mixed-evidence case-study design situated within a broader design-based research trajectory. It builds on, but is analytically distinct from, the earlier qualitative FABER study published in the International Journal of Digital Literacy and Digital Competence (Schiavo et al., 2026). The earlier work conceptualised the co-design atelier as a research and professional-learning device and combined thematic, discourse and conversation analysis to investigate professional learning in teacher–chatbot dialogue. The present analysis uses a different empirical slice and a more restrictive evidentiary logic: self-report data are analysed quantitatively as a baseline of declared design orientations, while documented conversational sequences are examined for observable teacher interventions and their consequences for the developing design.

This distinction is important for avoiding circular inference. The theoretical architecture of FABER was explicitly designed to ask contextual questions, offer alternatives and promote systems-oriented design; observing these features in the agent's outputs does not by itself demonstrate learning or agency. The current study therefore separates three levels of claim: (a) properties of the conversational format, such as the prevalence of questions; (b) observable interactional actions, such as a teacher adding a new constraint; and (c) outcomes such as improved pedagogical quality or professional learning. Only the first two levels are directly addressed by the available corpus.

2.2. Context, data sources and units of analysis

The empirical material concerns a professional-development experimentation conducted in May 2026. The accessible corpus comprises two distinct sources. The first is the original questionnaire export, a 59-field CSV with 19 records, all timestamped on 7 May 2026. It contains demographic/context variables, categorical items, 35 Likert-type items organised into seven conceptual blocks, open-ended questions and comments. Personally identifying fields (names, e-mail addresses and institutions) were excluded from all reported analyses.

The second source is an analytic presentation based on FABER interaction data collected from 7 to 9 May 2026. The presentation reports 144 paired user–agent exchanges associated with 14 user/group identifiers and approximately 18 sessions. The distribution by day is 102 exchanges on 7 May, 25 on 8 May and 17 on 9 May. It also provides aggregate punctuation indicators, thematic presence counts and selected dialogue excerpts. The raw chronologically ordered logs, complete

transcript boundaries, final artifacts and original coding file were not included in the materials available for the present re-analysis. Consequently, questionnaire respondents, interaction identifiers, sessions and turns are treated as non-equivalent units and no person-level matching is assumed.

The workshop materials describe FABER as a pedagogically structured agent that solicits information about school level, learners, disciplinary context and design constraints before proposing progressively more specific alternatives. Earlier FABER methodology conceptualised the atelier through activation, contextualisation and dialogic experimentation phases, with the conversational agent operating as a semiotic and cognitive mediator rather than a provider of final answers. That description informs the interpretation of the current corpus but is not treated as an empirical result of this study.

2.3. Questionnaire construction and analytical dimensions

The questionnaire derives from a research plan developed after an earlier qualitative analysis of FABER conversations. The instrument was originally conceived as a pre/post measure of transformations in teacher design thinking. In the dataset available here, however, only one administration is present; the study therefore uses it exclusively as a cross-sectional descriptive baseline. The seven five-item blocks operationalise: (1) goal specification/educational intentionality, (2) problem framing, (3) revision and reflexivity, (4) constructive alignment, (5) design agency, (6) management of complexity, and (7) sustainability, inclusion and systems orientation. The instrument also includes categorical choices and open-ended prompts corresponding to each block.

Each of the first six blocks contains one negatively phrased item. These items were reverse-scored using the transformation $6 - x$ before computing respondent-level means. The sustainability/inclusion/systems block contains five positively oriented items and required no reversal. Dimension scores are arithmetic means on the original 1–5 response scale. Because the instrument is developmental and the sample is small, the scores are explicitly treated as exploratory composites rather than validated latent scales.

2.4. Quantitative analysis

Descriptive analysis was performed on the 19 complete records. For the seven exploratory dimensions we calculated the mean, sample standard deviation and Cronbach's alpha. Alpha was calculated as $k/(k-1) \times [1 - \Sigma\sigma^2_i/\sigma^2\Sigma]$, with $k=5$. Internal consistency is reported as diagnostic information rather than used as a threshold for retaining or removing dimensions. Given $n=19$ and the absence of a matched post-test, no hypothesis tests, effect sizes for change, regression models or factor analyses were undertaken. Categorical items are reported as frequencies and percentages; when respondents selected multiple options, category counts are allowed to overlap and the text states this explicitly.

Open-ended questionnaire responses were used only to contextualise descriptive patterns. They were screened for directly relevant formulations concerning educational purpose, context, revision, alignment, adaptation, complexity and inclusion. They were not subjected to a new frequency-based qualitative coding because the present objective was to avoid treating short self-descriptions as independent proof of classroom behaviour. Illustrative excerpts are labelled by anonymised respondent identifiers.

2.5. Qualitative reading of interaction sequences

The qualitative component follows a structured documentary reading of the interaction evidence available in the analytic presentation. The previous IGI study used a hybrid deductive–inductive framework combining thematic analysis (Braun & Clarke, 2006), discourse analysis (Gee, 2014) and conversation analysis (Schegloff, 2007). That framework remains theoretically relevant, especially its attention to communicative intention, pedagogical function of chatbot responses, distribution of dialogic agency, reflective/systemic depth and indicators of professional learning. The current study, however, does not claim to replicate the full coding process because the raw logs are unavailable.

For each documented case, five analytic questions were applied: (1) What is the initial design object or request? (2) Which contextual information is elicited by the agent? (3) Which constraints or priorities are introduced by the teacher rather than supplied by the agent? (4) What changes in the proposed design after those teacher moves? (5) What stronger inference would require evidence that is currently missing? This evidence-to-claim procedure is intended to prevent illustrative excerpts from being treated as representative distributions.

Four interaction modes proposed in the SIREM abstract—extractive, incremental, evaluative and co-design—are retained as sensitising concepts. In this paper they are defined at the level of conversational segments rather than participants. Extractive interaction seeks a deliverable with little visible transformation; incremental interaction progressively adds context or constraints; evaluative interaction includes comparison, criticism, justification or rejection; co-design involves recursive redefinition of educational goals, activities or criteria while professional responsibility remains with the teacher. The present data are sufficient to illustrate these modes but not to estimate their prevalence or validate them as stable categories.

2.6. Integration strategy, validity and scope of inference

The two sources are integrated through conceptual triangulation rather than respondent-level triangulation. Survey results describe how the group reports approaching design in general; dialogue excerpts document selected local actions during FABER use. Because no verified key links a questionnaire respondent to a conversational session, correlations between self-reported agency and observed interaction are neither calculated nor implied. Convergence is discussed only at the

level of patterns, for example, high declared adaptation of external proposals alongside documented cases in which teachers introduce design constraints.

Validity is strengthened through explicit negative-case reasoning. The PHP example is intentionally retained because it shows a sequential interaction that is useful but less clearly reflective than the richer agricultural and energy cases. Similarly, a high frequency of FABER questions is interpreted as an affordance for elicitation, not as evidence that reflection occurred. The paper uses the strongest claim supported by each source and states the evidence that would be required for a stronger conclusion: complete pseudonymised logs, a codebook, independent coding, linked pre/post responses, final artifacts and, ideally, observations of classroom implementation.

3. Results

3.1. Participant profile and previous use of AI

The questionnaire sample comprised 19 respondents. Ten reported working in upper-secondary education, five in lower-secondary education, two in primary education, one in early-childhood education and one across lower- and upper-secondary levels. Teaching experience was heterogeneous: seven respondents reported 0–5 years, one 6–10 years, four 11–20 years and seven more than 20 years. Previous use of AI for instructional design was limited or intermittent: six reported never using it, four rarely, eight sometimes and one often. The group therefore combines experienced educators with relatively modest prior exposure to AI-assisted planning.

Table 1. Participant profile and prior use of AI for instructional design (n=19).

Variable	**Category**	**n (%)**
School level	Upper secondary	10 (52.6%)
	Lower secondary	5 (26.3%)
	Primary	2 (10.5%)
	Early childhood	1 (5.3%)
	Lower + upper secondary	1 (5.3%)
Teaching experience	0–5 years	7 (36.8%)
	6–10 years	1 (5.3%)
	11–20 years	4 (21.1%)
	>20 years	7 (36.8%)
Previous AI use	Never	6 (31.6%)
	Rarely	4 (21.1%)

Variable	Category	n (%)
	Sometimes	8 (42.1%)
	Often	1 (5.3%)

3.2. Exploratory dimensions of teacher design thinking

The seven descriptive composites reveal a differentiated rather than uniformly high profile. Design agency has the highest mean (M=3.99, SD=0.63), followed by constructive alignment (M=3.88, SD=0.54) and sustainability/inclusion/systems orientation (M=3.82, SD=0.71). Problem framing is also relatively high (M=3.73, SD=0.56). Revision/reflexivity is more moderate (M=3.53, SD=0.67), while goal specification has a lower composite mean (M=3.31, SD=0.63), partly reflecting the reverse-scored item concerning concentration on what students should do. Management of complexity is the lowest dimension (M=3.04, SD=0.66).

The reliability estimates are informative for interpretation. The sustainability/inclusion/systems block shows high internal consistency (α=.89) and agency reaches α=.70. Complexity (α=.64) and revision/reflexivity (α=.62) are moderate in this small sample. Goal specification (α=.56), problem framing (α=.59) and constructive alignment (α=.55) are weaker. The latter dimensions should therefore be interpreted primarily through individual item and categorical patterns rather than treated as stable scales. In practical terms, the questionnaire is more useful here as a structured map of design orientations than as a psychometric instrument.

Table 2. Exploratory five-item questionnaire dimensions (n=19).

Dimension	Mean	SD	Cronbach α
Goal specification / intentionality	3.31	0.63	.56
Problem framing	3.73	0.56	.59
Revision / reflexivity	3.53	0.67	.62
Constructive alignment	3.88	0.54	.55
Design agency	3.99	0.63	.70
Managing complexity	3.04	0.66	.64
Sustainability / inclusion / systems	3.82	0.71	.89

Note. Scores range from 1 to 5. In the first six dimensions the negatively phrased fifth item was reverse-scored. The sustainability/inclusion/systems block contains no reverse item. Alpha is reported descriptively; the composites have not been independently validated.

3.3. Categorical responses: adaptation is strong, complexity remains a tension

The categorical items sharpen the contrast between declared agency and complexity management. When asked what they do with external ideas, materials or

suggestions, 18 of 19 respondents selected adapting them to their context or reworking them personally (including multi-select responses); only one selected applying proposals as they are. This pattern is consistent with the high agency composite and with open responses emphasising coherence with educational goals, learner needs and contextual appropriateness.

Problem construction also appears salient. Thirteen respondents included "redefine the problem before designing" among their responses, whereas four selected proceeding directly to activity choice. Fifteen included "revise some choices during the process", and four also indicated significant reformulation of the project. These self-reports support the conceptual relevance of revision and problem framing, but they cannot establish how often those practices occurred in the FABER sessions.

Complexity produces a more ambivalent pattern. Ten respondents included "simplify as much as possible" when facing a complex design problem, while nine included organising the problem into progressive steps; some respondents selected both. Sustainability shows a similar gradient: six described it as structural to design, ten integrated it into some activities, one considered it occasionally and two did not consider it explicitly. These data suggest that the challenge for an AI-supported design environment is not merely to increase user autonomy. It is also to support decomposition without erasing relationships among educational, social and environmental dimensions.

The open responses are consistent with this reading. One respondent described beginning from the "overall educational meaning" of a pathway before translating it into observable and inclusive activities; another emphasised knowing learners and their personal context. Responses on agency repeatedly refer to adapting proposals according to objectives and learner needs. By contrast, complexity is frequently described through "simplifying", "segmenting" or making the pathway more linear. These statements are not behavioural measures, but they provide a useful interpretive baseline for the interaction sequences.

3.4. Interaction corpus and conversational architecture

The interaction presentation reports 144 paired exchanges across three days: 102 on 7 May, 25 on 8 May and 17 on 9 May. Fourteen user/group identifiers are represented and approximately 18 sessions are estimated. The distribution is therefore highly concentrated on the first day and should be interpreted as a bounded workshop episode rather than routine longitudinal use.

A striking descriptive feature is the asymmetry of questioning. The secondary analysis reports that 13 of 144 user inputs (9.0%) contain a question mark, compared with 138 of 144 FABER responses (95.8%); 100 agent responses (69.4%) end with a question. Median user-input length is reported as nine words. These figures describe a strongly agent-led elicitation structure. They do not imply that teachers are passive: in a constrained conversational architecture, a short answer can function as a consequential decision. At the same time, they show why agency

cannot be equated with turn-taking. The agent controls much of the local agenda by determining which question is asked next.

The source presentation also reports thematic presence counts across the interaction corpus: context/destinations (110), design (99), digital/AI/STEM (80), sustainability (72), active methodologies (51), systems thinking (45), assessment (26) and inclusion/SEN (16). Because the underlying coding file is unavailable, these frequencies are treated as secondary descriptive results rather than independently reproduced findings. Their most useful function is to identify which themes require close sequential inspection.

3.5. Case 1: from a generic sustainability topic to situated inclusive design

The agricultural-school sequence provides the clearest example of incremental contextualisation. The initial request—how to educate students about recycling—is broad and could be answered with a generic list of classroom activities. FABER first asks for school level. The teacher specifies an upper-secondary agricultural institute. After the agent reframes recycling around agricultural and business waste, the teacher adds a decisive contextual detail: the school operates its own production facilities for oil, wine, vegetables and greenhouse roses. This changes the object of design from "recycling education" to the mapping and valorisation of actual by-products generated by the school environment.

A second teacher move introduces an inclusion requirement: the user requests a specific activity for students with disabilities. FABER responds by translating the activity into image-based photographing and classification with clear, accessible group roles. What can be claimed from the sequence is therefore precise: the user supplies contextual and inclusion constraints that materially alter the proposed task. What cannot be claimed is equally important. Without the final artifact, learner profile, implementation data or external quality assessment, the sequence does not demonstrate that the resulting activity is accessible or instructionally effective. Its evidentiary value lies in showing teacher-originated specification and redirection.

3.6. Case 2: teacher-originated constraints and systemic expansion

The energy-efficiency case illustrates a stronger distribution of design initiative. The user begins by asking for a teaching base on the energy efficiency of homes. FABER asks for level and context; the teacher specifies a fourth-year technical institute and the energy field. After the agent offers alternative directions, the teacher introduces a more ambitious design object: a detached house that is autonomous not only energetically but also in relation to food. This move expands the problem from energy optimisation to a system involving energy, water, food, territory and lifestyles. The agent explicitly recognises this systemic extension.

The teacher then adds a second independent constraint: intensive use of artificial intelligence in the lesson. FABER incorporates AI as a technical assistant, critical sparring partner and object of systemic analysis. Here the strongest evidence of agency is not that the teacher responded repeatedly, but that teacher-generated

requirements reorganised the pedagogical problem. The sequence is consistent with the ecological account of agency: possibilities emerge relationally, but the user changes the trajectory rather than merely choosing among agent-provided options.

3.7. Case 3 and contrast case: adaptation versus operational specification

In the early-childhood sequence, the user first identifies the school level and then a homogeneous group of four-year-olds. Recycling is introduced as the theme, after which the participant asks to transform the pathway into STEM games. FABER translates the topic into concrete, sensory and movement-based play linked to early-childhood curriculum fields. This sequence shows developmental and curricular adaptation emerging through interaction. As in the agricultural case, however, the evidence concerns the transformation of the design representation, not implementation quality.

The PHP sequence functions as a useful contrast. The initial request concerns programming in the final year of upper-secondary school. FABER asks the user to choose among broad areas, then among programming basics, and subsequently between variables/types, loops and functions. The user at one point responds simply "1" and later selects guided individual mini-exercises. The agent constructs a coherent scenario around an online shop. This is a valuable planning interaction, but the documented sequence contains less evidence of problem reframing or evaluation. It is better described as operational specification or incremental scaffolding than as reflective co-design. Retaining this contrast prevents the model from treating every multi-turn interaction as agency-rich.

3.8. From cases to provisional interaction modes

Across the documented sequences, four modes can be used as provisional analytic descriptors. Extractive use is oriented toward obtaining an artifact with little visible revision. Incremental use is characterised by progressive addition of contextual information or constraints. Evaluative use requires a stronger action: comparing alternatives, questioning assumptions, asking for justification, identifying limitations, refusing a proposal or modifying it on principled grounds. Co-design refers to recursive cycles in which educational purposes, learner characteristics, activities or assessment criteria are repeatedly redefined, with the teacher retaining responsibility for the final configuration.

The current evidence strongly illustrates incremental interaction and provides some indicators of co-design, particularly where teacher-originated constraints alter the problem. Evidence for evaluative interaction is thinner in the selected excerpts, because explicit rejection, criticism or requests for justification are less visible. This asymmetry is analytically useful: the four modes should not be presented as a developmental ladder or as equally represented empirical categories. Complete logs may show transitions in both directions, and a session may alternate among them.

Table 3. Evidence-to-claim matrix for the selected interaction cases.

Case		Trace-supported observation	Inference not established
	Agricultural recycling	Teacher adds school production context and later an explicit disability-related constraint; the task is reformulated accordingly.	Accessibility, learning effectiveness, or quality of the final implemented design.
	Energy-autonomous house	Teacher introduces food autonomy and intensive AI use, expanding the initial energy problem into a broader system.	Independent teacher authorship of all choices or superiority over alternative design processes.
	Early childhood / STEM	Age, recycling theme and STEM-play preference lead to developmental and curricular translation.	Feasibility or learning outcomes in an actual early-childhood setting.
	PHP	Successive selections narrow content and activity format, leading to a coherent exercise scenario.	Reflective co-design; short option selections alone are insufficient evidence of reflective agency.

3.9. Cross-source interpretation

The survey and interaction evidence converge only at a conceptual level. The group reports strong adaptation of external proposals and a high exploratory agency score, while selected conversations include instances in which teacher-supplied constraints redirect the agent. At the same time, the survey shows weaker management of complexity and frequent reliance on simplification, whereas the interaction cases show that FABER itself often decomposes the design problem through sequential questions and predefined options. This convergence identifies a central tension rather than proving an effect: scaffolding can make a complex problem manageable, but the same scaffolding may also determine which aspects of the problem become visible.

No respondent-level association can be tested because questionnaire and interaction identifiers are not linked. It is therefore methodologically incorrect to infer that respondents with higher agency scores produced more agent-resistant or co-design interactions. The value of combining the sources is different: the questionnaire identifies a plausible professional baseline, while the sequences reveal candidate behaviours through which agency could be operationalised in future linked studies.

4. Discussion

4.1. From artifact quality to the distribution of pedagogical control

The main contribution of this study is to relocate the analysis of AI-supported instructional design. Much current discussion starts from the quality, accuracy or usefulness of the generated artifact. Those outcomes matter, but they do not answer who is designing. A high-quality lesson plan can be generated through extensive teacher deliberation or through near-total delegation. Conversely, a rough intermediate artifact may be pedagogically productive if it triggers problem

reframing and critical revision. The relevant unit is therefore the distribution of pedagogical control across the sequence.

This perspective complements the earlier FABER study, which characterised the agent as an epistemic partner supporting professional learning (Schiavo et al., 2026). The present analysis introduces a stricter criterion: partnership should be inferred from reciprocal transformation of the design problem, not from conversational fluency alone. The agent contributes by eliciting context, opening alternatives and externalising design possibilities. The teacher contributes agency when those possibilities are accepted selectively, modified, challenged or redirected according to pedagogical purposes that cannot be reduced to the agent's default trajectory.

4.2. Questioning as scaffolding—and as choice architecture

The strong asymmetry in question marks is one of the most revealing descriptive findings. FABER systematically asks questions and often ends a response with an invitation to make another choice. This is consistent with scaffolding models in which support structures complex activity and reduces cognitive load (Jonassen, 1999). It also fits dialogic accounts in which questioning externalises assumptions and sustains joint meaning-making (Mercer, 2000). Yet the same mechanism can operate as choice architecture: the system determines when clarification is needed, what categories are relevant and which alternatives are salient.

The pedagogical design implication is not that agents should ask fewer questions. Rather, agency-oriented agents should create space for user-generated reframing. They can do this by offering an "other/reframe" path, asking users to critique proposed alternatives, explicitly inviting rejection, requesting the rationale for a choice, and periodically returning control to the user with prompts that do not presuppose the next design dimension. Such features would operationalise the difference between guided completion and reflective co-design.

4.3. Agency is relational, but responsibility cannot be distributed away

The ecological view of agency helps avoid two symmetrical errors. The first is technological determinism: assuming that a well-designed conversational agent produces agency. The second is methodological individualism: assuming that agency resides entirely inside the teacher and can be measured independently of the interaction environment. The cases suggest a relational account. The agent makes certain actions possible and prompts particular distinctions; teachers bring contextual knowledge, educational priorities and professional responsibility. Agency is achieved in the relation, but accountability for the pedagogical decision cannot simply be attributed to the relation as an abstract entity.

This is especially relevant in educational applications of generative AI, where fluent suggestions may obscure uncertainty. An agency-oriented system should make its limitations visible, support source verification and distinguish between generative proposals and evidence-based recommendations. It should also avoid presenting a

complete pedagogical architecture too early, because premature completeness can reduce the need for the user to formulate the problem. The design goal is not maximum assistance but calibrated assistance.

4.4. The agency–complexity tension

The most productive quantitative finding is the contrast between high declared agency and lower management of complexity. The result should not be read as a statistical opposition between validated constructs; the scales are exploratory and some show limited internal consistency. It nonetheless identifies an important pedagogical problem. Teachers may feel responsible for adapting proposals while still preferring to reduce complex design problems to manageable linear sequences. This is understandable: professional action requires simplification. The issue is whether simplification becomes reductionism.

The sustainability and systems-thinking orientation of FABER makes this tension especially visible. Systems education asks teachers to preserve interdependence, feedback and multiple perspectives (Meadows, 2008; Senge, 1990), while classroom planning requires actionable steps. The agent's pedagogical value may therefore lie less in producing more complex plans than in supporting reversible movement between levels: decomposing a problem for action and then reconnecting the parts to the larger system. Future versions of FABER could explicitly incorporate "zoom out" prompts, relationship checks and counterfactual questions designed to prevent progressive specification from silently eliminating complexity.

4.5. Methodological implications for researching teacher–AI co-design

The study also suggests methodological criteria for future research. First, session length and prompt length should be treated as descriptive variables, not proxies for engagement. Second, coding should focus on actions and transitions: introduction of a new constraint, acceptance, modification, rejection, justification request, reframing and return to previous decisions. Third, modes should be coded at segment level because the same teacher may move from extraction to evaluation and back within a single session. Fourth, negative cases are essential. A credible model of co-design must identify sequences in which the agent dominates, users simply comply, or an apparently sophisticated dialogue does not change the final artifact.

Finally, conversational analysis should be linked to design artifacts. The strongest evidence of teacher agency would be a traceable chain from a conversational intervention to a change in the final plan, accompanied by a rationale articulated by the teacher. Matched pre/post measures and stimulated-recall interviews could then investigate whether repeated interaction changes how teachers frame design problems beyond the immediate session. These additions would transform the current sensitising framework into a testable model of AI-mediated design engagement.

4.6. From situated design decisions to teacher professional learning: a pedagogical interpretation of the qualitative evidence

The qualitative evidence examined in this study offers an opportunity to further explore the pedagogical significance of teacher agency in AI-mediated instructional design. Building on the conception of professional agency developed in the theoretical framework, the central issue is not simply whether teachers actively participate in conversational exchanges, but how their professional knowledge, educational intentions and contextual understanding inform the decisions made throughout the design process. From this perspective, conversational interaction can be interpreted as a space in which certain dimensions of pedagogical reasoning become visible, without assuming that observable participation necessarily corresponds to reflective engagement or professional learning.

The open-ended questionnaire responses provide a relevant starting point for this interpretation. References to the overall educational meaning of a learning pathway, knowledge of learners and their contexts, and the need to adapt external proposals suggest an orientation towards instructional design as an intentional and situated professional practice. This interpretation is consistent with the categorical responses, in which 18 of 19 participants selected adapting or personally reworking external suggestions, while 13 included redefining the problem before designing and 15 included revising choices during the process. Although these statements cannot be considered direct evidence of enacted professional agency, they indicate the relevance participants attribute to contextual interpretation and pedagogical decision-making. In Shulman's (1987) terms, such orientations are consistent with an understanding of teaching as pedagogical reasoning and action, in which professional knowledge is mobilised to transform educational purposes into meaningful learning opportunities.

The documented interaction sequences offer a complementary perspective by illustrating how particular teacher-originated interventions influence the emerging design. In the agricultural-school case, the introduction of the school's production context and the subsequent attention to students with disabilities redirect a generic sustainability topic towards a more situated educational problem. In the energy-efficiency case, the teacher's introduction of food autonomy expands the initial task into a broader systemic configuration. These examples suggest that professional agency may become visible when teachers mobilise contextual knowledge and educational priorities to redefine the object of design. However, the contrast provided by the PHP sequence demonstrates that progressive specification and the successful production of an instructional scenario do not necessarily involve critical reconsideration of pedagogical assumptions. The distinction is therefore not between more and less competent teachers, but between interactional sequences that provide different degrees of evidence of professional judgement.

A pedagogically significant aspect of these findings concerns the relationship between contextualisation, reflection and professional learning. Professional judgement cannot be reduced to the ability to select among alternatives or to provide increasingly detailed information to a conversational system. It also involves examining the educational grounds on which particular choices are considered appropriate. As Loughran (2002) argues, meaningful reflective practice requires

opportunities to question taken-for-granted assumptions and to reconsider professional experience from alternative perspectives. In AI-mediated instructional design, this suggests the importance of distinguishing between conversational scaffolding that facilitates task completion and dialogic processes that create opportunities for examining the reasons, values and assumptions informing pedagogical decisions. The evidence available in this study illustrates some instances of contextual redirection, while providing more limited documentation of explicit criticism, justification requests or sustained reflective reconsideration.

This distinction also has implications for understanding professional development. Teacher learning is a complex and situated process that cannot be explained solely through participation in a particular activity or exposure to new technological resources. Opfer and Pedder (2011) emphasise reciprocal relationships among teachers, professional learning activities and school contexts, challenging linear interpretations of professional development. Similarly, Korthagen (2017) highlights the importance of connecting professional experiences with cognitive, emotional and motivational dimensions of teacher learning. From this perspective, conversational AI may create opportunities for professional inquiry when it encourages teachers to articulate pedagogical rationales, confront alternative interpretations and reconsider the relationships between educational purposes, learner characteristics and instructional choices. Nevertheless, the existence of such opportunities does not demonstrate that professional knowledge or agency has been transformed.

An important pedagogical implication concerns the design of AI-supported professional learning environments. Rather than considering the conversational agent exclusively as a resource for generating instructional solutions, co-design ateliers could incorporate structured opportunities for reflective interpretation before, during and after interaction. Teachers could be invited to explain the educational rationale behind their choices, identify assumptions embedded in AI-generated proposals, examine alternatives that were not initially considered and critically reconstruct the decisions leading to the final instructional design. Such practices would be consistent with an inquiry-oriented conception of teacher professionalism, in which teachers are recognised as active interpreters and producers of professional knowledge (Cochran-Smith & Lytle, 2009). These proposals represent possible directions for the pedagogical development of future ateliers rather than practices whose effectiveness has been established by the present study.

Overall, the qualitative perspective contributes to distinguishing the situated enactment of teacher agency from its possible development through professional learning. The present findings do not establish that interaction with FABER produces sustained changes in teachers' professional understanding or practices. They nevertheless identify observable decisions and interactional conditions that may inform future investigations of agency-oriented professional development. The pedagogical challenge is therefore not merely to increase the efficiency of AI-supported instructional design, but to create conditions in which teachers can preserve, articulate and critically exercise their professional judgement while remaining responsible for the educational meaning of the choices they make.

5. Conclusions

This exploratory study does not demonstrate that interaction with FABER increases teacher agency or improves instructional quality. Rather, it contributes to understanding how professional agency may be exercised and made partially visible within AI-mediated instructional design. The findings highlight the importance of distinguishing conversational participation from pedagogically meaningful decision-making. Questionnaire responses indicate a strong self-reported orientation towards adapting external proposals to educational purposes and learners' needs, alongside greater uncertainty in managing complex design problems. The documented interaction sequences illustrate how teacher-originated contextual constraints and educational priorities can redirect the emerging design, while also revealing the extent to which the conversational agent shapes the interaction through questions and predefined alternatives.

From a pedagogical perspective, these findings invite a broader reflection on the relationship between teacher agency, professional knowledge and educational judgement. The significance of AI-mediated instructional design cannot be reduced to the production of coherent instructional artifacts or the progressive specification of teaching activities. It also concerns the opportunities available for teachers to mobilise contextual knowledge, articulate educational intentions, critically examine proposed solutions and assume responsibility for pedagogical decisions. In this sense, agency should not be understood merely as the capacity to influence the output of a technological system, but as the situated exercise of professional judgement within a complex educational environment. The qualitative evidence contributes to this interpretation by identifying instances in which teachers' contextual knowledge and educational priorities become consequential for the developing design, without establishing whether such interactions produce sustained professional learning.

The distinction between extractive, incremental, evaluative and co-design interaction therefore represents a provisional analytical framework for investigating different forms of participation and pedagogical decision-making in AI-supported design processes. Its contribution lies in shifting attention from whether teachers use artificial intelligence to how they interpret, negotiate and critically engage with its proposals. From a professional development perspective, conversational agents such as FABER may offer opportunities for reflective inquiry when interaction encourages teachers to justify choices, reconsider assumptions and connect instructional decisions to broader educational purposes. However, the development of professional agency cannot be inferred from conversational activity alone and requires further longitudinal and practice-based evidence. The pedagogical challenge is therefore not simply to design AI systems capable of providing effective instructional support, but to create conditions in which teachers can preserve, articulate and critically exercise their professional judgement while remaining responsible for the educational meaning of their decisions.

5.1. Limitations and future research

The study is limited by the small convenience questionnaire sample (n=19), a single available administration rather than the planned pre/post design, exploratory author-constructed scales with uneven internal consistency, the absence of a verified link between questionnaire respondents and interaction sessions, reliance on selected interaction excerpts, and the unavailability of the raw ordered logs for independent recoding. The available material also lacks independent ratings of final instructional artifacts and classroom implementation data. Consequently, the paper cannot estimate effects on professional learning, compare interaction modes statistically or establish causal improvement in instructional quality.

The immediate next step is a complete corpus analysis using pseudonymised raw logs. A coding manual should define interactional actions and the four provisional modes, include rules for segment boundaries and ambiguous cases, and be applied independently by at least two coders. The analysis should report agreement and disagreement, transitions between modes, negative cases and associations with characteristics of final artifacts. A subsequent linked design could pair interaction traces with pre/post measures and stimulated-recall interviews. Such a programme would allow the field to move from compelling examples of teacher–AI dialogue toward robust evidence about how professional agency is enacted and developed.

5.2. Pedagogical implications for the design of teacher professional-development ateliers

The findings of this exploratory study suggest several pedagogical considerations for the future design of professional-development ateliers involving conversational artificial intelligence. Rather than organising these experiences exclusively around the production of instructional artifacts, teacher education programmes could place greater emphasis on the processes through which teachers formulate educational problems, exercise professional judgement and critically reconsider their design decisions. From this perspective, AI-mediated co-design may be conceived as an opportunity for professional inquiry, provided that teachers retain an active role in defining educational purposes and evaluating the pedagogical relevance of generated proposals.

Future ateliers could incorporate structured moments of reflection before, during and after interaction with the conversational agent. An initial phase could invite teachers to articulate their educational intentions, contextual assumptions and expectations concerning learners. During the interaction, specific reflective checkpoints could encourage participants to examine the assumptions embedded in AI-generated suggestions, compare alternative pedagogical approaches and justify the reasons for accepting, modifying or rejecting proposed solutions. A final reflective phase, potentially supported by a teacher educator or facilitator, could focus on reconstructing the design trajectory, identifying significant decisions and examining how the initial formulation of the educational problem was maintained or transformed.

Particular attention could also be devoted to the inclusive and systemic dimensions of instructional design. Teachers could be encouraged to question whether generated proposals adequately address learner diversity, potential barriers to participation and the interdependencies characterising complex educational situations. The purpose of these activities would not be to prescribe a single model of interaction with artificial intelligence, but to create conditions in which teachers can exercise informed pedagogical judgement and critically engage with the possibilities and limitations of technological mediation.

These considerations represent pedagogical design propositions rather than outcomes empirically validated by the present study. Their broader significance lies in suggesting that the educational value of conversational AI in teacher professional development should not be assessed solely in terms of efficiency or artifact production, but also in relation to the opportunities it creates for intentionality, critical reflection and the responsible exercise of professional agency.

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