



Teachers' and pre-service teachers' perceptions of integrating scientific concepts into everyday life in classroom teaching

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ABSTRACT

This study examined how in-service and pre-service science teachers perceive the pedagogical value of linking scientific concepts to everyday life. The study involved 120 Arabic-speaking participants from northern Israel, 60 in-service science teachers and 60 third-year pre-service science teachers, who completed a researcher-developed questionnaire before and one week after a brief video-based intervention. The instrument measured perceived effects of everyday-life integration on student engagement, interest and curiosity, and achievement across chemistry, physics, biology, and technology. Internal consistency was high across the three subscales ($\alpha = .87$ to $.91$). Correlations among the three perceived outcomes were positive at pre-test and became stronger at post-test. Mixed ANOVA results showed significant time effects and significant group $\times$ time interactions across all three dimensions and all four subject domains, with in-service teachers reporting slightly more favorable perceptions than pre-service teachers at both time points. The findings indicate that a short, carefully modeled intervention can strengthen teachers' beliefs about contextualized science teaching, but the findings reflect changes in participants' perceptions of pedagogical value rather than direct measures of student learning. The study contributes a bounded but useful account of how career stage shapes responses to context-based science teaching in one regional and sociocultural setting.

Keywords: context-based science teaching, everyday-life connections, teacher perceptions, pre-service teachers, science education

INTRODUCTION

Connecting school science to everyday experience has long been treated as a central condition for meaningful learning. Context-based science education does not simply add examples to abstract content. Rather, it organizes concepts through situations, problems, practices, and phenomena that students can recognize and reason about, which can strengthen relevance, motivation, and conceptual coherence (Bennett et al., 2007; Gilbert, 2006; National Research Council, 2012). Recent work has continued to frame relevance as a major concern in science education, whether through sustainability, ethnoscience, STEM integration, open schooling, or inquiry-oriented pedagogies (Bossér, 2024; Okada, 2024; Puspita et al., 2024; Safkolam et al., 2024). Across these lines of work, the recurring argument is that science becomes more teachable and more learnable when learners can recognize why the knowledge matters outside the textbook.

That argument is especially important for teachers and pre-service teachers, because classroom relevance is not built automatically into a curriculum. It is enacted through instructional judgment, the choice of examples, the framing of questions, and the degree to which teachers invite students to move between

disciplinary ideas and lived situations. Research on teacher beliefs has shown that what teachers regard as worthwhile, feasible, and educationally productive often shapes practice as strongly as formal curricular intentions do (Pajares, 1992). In science education, this point has appeared in studies of pedagogical content knowledge, integrated STEM education, professional development, and instrument validation, all of which suggest that teachers' beliefs about relevance and applicability influence how they design learning experiences (Bybee, 2013; Martins & Baptista, 2024; Vargas et al., 2024). Examining teachers' perceptions is therefore not a secondary matter. It is one way of studying the conditions under which context-based teaching is likely to be adopted, adapted, or resisted.

The literature provides substantial support for teaching that connects science with authentic settings, yet it also reveals an uneven evidence base. Earlier international scholarship established the rationale for context-based science education by showing that everyday situations can help students activate prior knowledge, encounter a need to know, and move between concepts and experience (Bennett et al., 2007; Gilbert, 2006; Pilot & Bulte, 2006; Rivet & Krajcik, 2008). More recent work has extended that rationale to scientific literacy, sustainability, integrated STEM education, programming, and science connection to life (Bossér, 2024; Kong & Lin, 2024; Okada, 2024; Puspita et al., 2024). Other studies address teachers' perceptions of STEM education and active science teaching in national or subject-specific contexts (Alsalamat, 2024; Fitriyana et al., 2024; Tan & Wei, 2024). Together, these studies suggest that relevance matters, but they do not answer the narrower question that motivates the present study, namely how teachers at different career stages judge the perceived effects of everyday-life integration after encountering the same modeled intervention.

The present study was therefore positioned at the intersection of two evidence traditions that are sometimes kept apart. One tradition asks whether contexts can make science more intelligible to learners; the other asks how teachers come to judge an instructional approach as worthwhile. The first tradition is represented by work on context-based learning, project-based science, scientific literacy, and curriculum standards (Bennett et al., 2007; National Research Council, 2012; Rivet & Krajcik, 2008). The second is represented by research on teacher beliefs and professional learning, which treats teachers' interpretive frameworks as part of the mechanism through which curricula become classroom practice (Kong & Lin, 2024; Pajares, 1992). Bringing these traditions together is useful because a context-rich curriculum cannot influence learners unless teachers understand it, trust it, and can imagine enacting it within real classroom constraints.

The distinction between in-service and pre-service teachers is theoretically and practically important. In-service teachers interpret pedagogical ideas through accumulated experience with student responses, curricular pacing, assessment demands, and classroom management. Pre-service teachers often approach the same ideas with greater openness to innovation but less grounded knowledge of classroom enactment. Prior studies on teacher cognition, STEM readiness, teacher development, and curriculum ideology indicate that professional experience shapes how educators evaluate instructional feasibility, not only whether they approve of a pedagogical idea in principle (Kong & Lin, 2024; Pajares, 1992; Tan & Wei, 2024). Comparing these two groups under a common intervention can therefore clarify whether everyday-life integration is received primarily as an attractive idea, a credible teaching strategy, or both.

The present study addresses this issue in the Arab educational sector in northern Israel. This context matters because science teaching there is shaped by linguistic mediation, local sociocultural expectations, and the institutional structures of regional teacher education. The study does not measure students' engagement, curiosity, or achievement directly. Instead, it investigates teachers' and pre-service teachers' perceptions of how everyday-life integration is likely to influence those outcomes. This distinction is essential. The study documents changes in participants' perceptions following a standardized, cross-disciplinary, video-based modeling experience. Within that bounded frame, the study offers three contributions: it compares two career stages, it disaggregates perceptions across four science subject domains, and it identifies how perceived relationships among engagement, curiosity, and achievement shift after exposure to an intervention that explicitly models everyday-life connections.

A related issue concerns the curricular status of everyday-life connections. International frameworks now treat relevance, application, and phenomena as central rather than peripheral components of science education. The National Research Council (2012) framed science learning around practices, crosscutting concepts, and core ideas that gain force when they are enacted through observable phenomena. The next

generation science standards similarly institutionalized the movement away from isolated fact transmission toward instruction organized through explanation, modeling, and real-world problem solving (NGSS Lead States, 2013). Although the present study was not designed around those specific standards, it shares their underlying pedagogical assumption: students are more likely to engage with science when the content is presented as a tool for interpreting the world they inhabit. Teachers' willingness to adopt that assumption is therefore an important object of inquiry in its own right.

This curricular framing also guards against a common misunderstanding of everyday-life integration. The issue is not whether teachers should mention familiar objects, foods, devices, or health practices. Such references can remain superficial if they do not lead students toward explanation, modeling, evidence, or conceptual discrimination. Context becomes pedagogically productive when it creates a reason for the concept to be learned and when the teacher makes explicit movement between the everyday situation and the disciplinary account. The study's intervention was designed around this movement. Each video began with a recognizable situation, named the relevant scientific idea, and then returned to the situation to show how the idea clarifies what is happening. In this respect, the intervention reflected the logic of context-based curriculum design rather than a collection of attractive examples.

Recent international scholarship also shows that the language of relevance is being mobilized for different educational ends. In some studies, relevance is tied to sustainable development and environmental citizenship (Altıntaş et al., 2024; Puspita et al., 2024). In others, it is linked to STEM preparedness, scientific creativity, or perceived future work intentions (Alsalamat, 2024; Pont-Niclòs et al., 2024). Some investigations emphasize the special role of curiosity and inquiry in generating lasting interest, particularly when teachers frame phenomena as open problems rather than as illustrations of already settled content (Safkolam et al., 2024). These strands do not all define context in the same way, yet they converge on the idea that science teaching loses power when it is detached from recognizable purposes. This convergence justifies the present study's decision to focus specifically on perceived engagement, curiosity, and achievement, three outcomes that sit at the intersection of motivational and academic concerns.

Three strands of scholarship informed the conceptual framing. The first is the literature on context-based science teaching, which argues that context is not merely decorative but epistemically productive when it helps learners enter a problem, organize concepts, and see why scientific explanations are useful (Bennett et al., 2007; Gilbert, 2006; Pilot & Bulte, 2006). Recent studies have advanced this argument in varied directions, including integrated STEM, sustainability education, and real-world problem framing (Bybee, 2013; Fitriyana et al., 2024; Puspita et al., 2024). The second is the literature on scientific literacy and connection to life, which links relevance to students' willingness to participate, persist, and see science as socially consequential (Bossér, 2024; Okada, 2024). The third concerns teacher cognition, especially the role of beliefs and perceptions in shaping pedagogical decisions (Pajares, 1992). From this perspective, perceptions of likely student engagement or learning are not trivial opinions. They are part of the practical reasoning through which teachers decide whether a strategy is worth using.

A further premise of the study is that short, well-focused professional learning experiences can reshape pedagogical perception even when they do not aim at full-scale behavioral change. Recent work on teacher development has shown that modeling, concrete exemplars, and reflection-oriented materials can alter how teachers evaluate student-centered approaches (Kong & Lin, 2024; Martins & Baptista, 2024). This is especially plausible when the intervention makes tacit instructional moves visible, for example by showing how a chemistry concept can emerge from household routines or how technological principles can be tied to familiar devices. For pre-service teachers, such modeling can provide a bridge from coursework to imagined practice. For in-service teachers, it can supply new language or sharper justification for strategies they already use in fragmentary ways. In both cases, the outcome of interest is perceptual reorganization, that is, a change in how participants understand the pedagogical value of contextualized teaching.

The literature also suggests that context-based teaching is not a single method but a family of pedagogical decisions whose success depends on the quality of the bridge between everyday situations and disciplinary ideas. Project-based and context-based studies have shown that familiar experience supports learning only when it is organized into disciplined inquiry rather than left as a loose example (Pilot & Bulte, 2006; Rivet & Krajcik, 2008). Work on curriculum ideology, practical work, and subject-specific teaching has likewise shown

that teachers may endorse relevance in principle while still struggling to identify contexts that are scientifically accurate, instructionally productive, and culturally recognizable (Tan & Wei, 2024; Vargas et al., 2024). This tension is especially salient in teacher education. Pre-service teachers are often encouraged to make lessons authentic, but they may lack repertoires of examples or may overestimate the motivational effect of context without knowing how to sustain conceptual clarity. Conversely, experienced teachers may know many examples but use them episodically rather than systematically. A comparative design that examines both groups after exposure to the same materials can therefore illuminate not only whether they approve of contextualization, but how strongly they associate it with meaningful instructional outcomes.

The decision to develop a study-specific instrument was also substantive. Existing measures in science education often address students' attitudes toward science, science connection to life, or teachers' broader STEM orientations, but fewer tools target teachers' judgments about the likely consequences of everyday-life integration across multiple school science domains. Okada (2024) provides an important recent example of measuring science connection to life from the learner's perspective, while Osborne et al. (2003) remains a foundational review of how attitude research should be conceptualized and interpreted. Work on instrument validation in science education has likewise emphasized the need to align constructs, items, and intended claims with precision (Vargas et al., 2024). For that reason, the present questionnaire was framed narrowly around perceived pedagogical effects rather than around a diffuse notion of attitude toward science teaching.

For that reason, the instrument did not ask whether participants liked science, whether they supported innovation in general, or whether they believed that science is useful in society. Those constructs are important, but they would not match the specific empirical claim made here. The questionnaire asked participants to judge the likely pedagogical effect of everyday-life integration on three classroom outcomes that teachers routinely consider when planning lessons: participation, curiosity, and achievement. This narrower design helped keep the interpretation of the results aligned with the data. It also responded to methodological cautions in attitude research by avoiding a mixed scale that would combine many different attitude objects into one ambiguous score (Osborne et al., 2003).

The cross-disciplinary structure of the study also deserves emphasis. Much of the literature on contextualized teaching is domain-specific. Chemistry studies often discuss abstraction, particulate explanations, or the relationship between symbolic and macroscopic reasoning; biology studies frequently draw on health, environment, or living systems; technology and engineering studies may emphasize design and use; and physics studies often rely on movement, energy, and everyday mechanics (Bennett et al., 2007; Fitriyana et al., 2024; Gilbert, 2006). Yet teachers in schools seldom experience science teaching as neatly segmented at the level of pedagogical thinking. They develop general views about whether real-life integration is effective, and those views may then be expressed differently across subjects. By examining chemistry, physics, biology, and technology within the same design, the study captures both a general pedagogical orientation and its domain-specific shading.

Against this background, the study asked whether a brief video intervention that explicitly connected chemistry, physics, biology, and technology to everyday situations would alter participants' perceptions of three student-related outcomes, engagement, interest and curiosity, and achievement. The research questions (RQs) were as follows:

RQ1. How are participants' perceived student engagement, interest and curiosity, and achievement related to one another before and after the intervention, within each science subject domain?

RQ2. Do in-service and pre-service teachers differ in their perceptions of the effect of everyday-life integration on student engagement, and does that difference change from pre-test to post-test?

RQ3. Do in-service and pre-service teachers differ in their perceptions of the effect of everyday-life integration on student interest and curiosity, and does that difference change from pre-test to post-test?

RQ4. Do in-service and pre-service teachers differ in their perceptions of the effect of everyday-life integration on student achievement, and does that difference change from pre-test to post-test?

The corresponding hypotheses were intentionally framed in perceptual terms. **H1** predicted positive associations among the three perceived student outcomes at both time points, with stronger correlations after the intervention. **H2** to **H4** predicted that in-service teachers would report more favorable perceptions

Table 1. Demographic characteristics of the participants

Variable	In-service teachers (n = 60)	Pre-service teachers (n = 60)
Gender	22 men (36.7%), 38 women (63.3%)	10 men (16.7%), 50 women (83.3%)
Age, M (SD)	40.05 (8.47)	22.43 (1.88)
Teaching seniority, M (SD)	14.80 (8.76)	Not applicable
Highest qualification	35 bachelor's (58.3%), 25 master's (41.7%)	Third-year BEd candidates
Teaching fields	Chemistry, physics, biology, and technology	Science education specialization with practicum exposure

than pre-service teachers and that both groups would show higher scores after the intervention, yielding significant time effects and group $\times$ time interactions across subject domains.

METHOD

Research Design

The study used a quantitative repeated-measures design with two naturally occurring participant groups, in-service science teachers and pre-service science teachers. All participants completed the same measures before the intervention and again one week after the intervention. Because there was no control group, the design is best understood as a pre-post comparison study rather than a true experiment. Its value lies in estimating short-term attitudinal change under a common instructional stimulus and in comparing that change across career stage and subject domain.

Context and Participants

The study was conducted in the Arab educational sector in northern Israel. Pre-service participants were enrolled in the third year of a Bachelor of Education program in science education at a regional college of education. This stage was selected because students had already completed foundational coursework in pedagogy and disciplinary content and had begun supervised practicum experiences. The in-service participants were practicing science teachers working in local middle and high schools and teaching one or more of the following areas: chemistry, physics, biology, or technology.

A convenience sample of 120 participants was recruited through institutional contacts with the college and neighboring schools. The sample included 60 in-service teachers and 60 pre-service teachers. The in-service group included 22 men (36.7%) and 38 women (63.3%), with a mean (M) age of 40.05 years (standard deviation [SD] = 8.47) and an M teaching seniority of 14.80 years (SD = 8.76). Thirty-five held a bachelor's degree (58.3%) and 25 held a master's degree (41.7%). The pre-service group included 10 men (16.7%) and 50 women (83.3%), with an M age of 22.43 years (SD = 1.88). Because they were still in training, they had not yet accumulated independent teaching seniority and had not completed the degree program. **Table 1** presents the demographic profile.

The local context sharpens the importance of this question. Science teaching in Arabic-speaking schools in Israel often involves mediation across scientific terminology, school language practices, and community experience. Everyday-life examples can support that mediation because they anchor new language in recognizable situations. At the same time, not every context is equally available or equally persuasive for all students, which means that teachers need sensitivity to local routines, material realities, and cultural references when they contextualize science. This consideration informed both the intervention design and the translation process used in the questionnaire. By focusing on one regional setting, the study gains contextual specificity while accepting reduced breadth of generalization.

Instrument Development and Measures

The primary measure was the everyday-life integration perception questionnaire, a researcher-developed instrument designed specifically for this study. Item construction was informed by scholarship on context-based science teaching, teacher cognition, scientific literacy, and teacher professional learning (Bennett et al., 2007; Bossér, 2024; Okada, 2024; Pajares, 1992). The resulting instrument targeted perceived effects of everyday-life integration on three student-related dimensions: engagement, interest and curiosity, and

Table 2. Structure and validation summary of the everyday-life integration perception questionnaire

Subscale	Construct captured	Illustrative item	Items	α
Perceived engagement	Expected student participation, attention, and involvement	Linking science to daily situations would increase students' participation in the lesson.	10	.88
Perceived interest and curiosity	Expected questioning, interest, and curiosity toward the topic	Everyday-life examples would make students more curious about the scientific idea being taught.	10	.87
Perceived achievement	Expected understanding, retention, and academic performance	Connecting science to familiar situations would improve students' understanding of lesson content.	10	.91

Note. The instrument was researcher-developed for the present study, reviewed by three bilingual science education specialists, translated and back-translated, piloted with 20 participants, and retained in a three-subscale form

Table 3. Overview of the video-based intervention materials

Video	AD	Everyday-life anchor	Core science focus	Teacher-facing modeling emphasis
Chemistry	7 min.	Cooking, cleaning agents, rusting	Chemical change, reactions, acid-base ideas	How familiar transformations can open conceptual explanation
Physics	7 min.	Cycling, braking, movement, electricity use	Force, motion, energy transfer	How motion and energy examples can trigger prediction and discussion
Biology	8 min.	Exercise, respiration, digestion, daily health	Body systems and biological processes	How bodily experience can support questioning and explanation
Technology	8 min.	Smart devices, sensors, algorithms	Design logic, automation, technological principles	How familiar digital tools can strengthen relevance and perceived usefulness

Note. AD: Approximate duration

achievement. Each dimension contained 10 Likert-type items scored from 1, strongly disagree, to 5, strongly agree.

Questionnaire development proceeded in several stages. First, an item pool was written in English and translated into Arabic. Three bilingual science education specialists reviewed the wording for conceptual fidelity, clarity, and local relevance. The instrument was then back-translated into English to check equivalence. Minor revisions were made to examples and classroom wording so that the items would fit the linguistic and pedagogical realities of Arabic-speaking schools and teacher education. A pilot administration with 20 participants, 10 in-service teachers and 10 pre-service teachers who were not included in the main study, was used to identify ambiguous items and reduce redundancy. The final form retained 30 items. Internal consistency in the main sample was high, with Cronbach's alpha values of .88 for perceived engagement, .87 for perceived interest and curiosity, and .91 for perceived achievement. The overall scale alpha was .89. Content validity was established through expert review, and the retained three-dimensional structure was consistent with the conceptual design of the instrument. **Table 2** summarizes the questionnaire.

A brief demographic form was administered alongside the questionnaire. Participants also completed short subject prompts tied to the intervention materials in chemistry, physics, biology, and technology. These prompts were used only as attention and processing checks and were not part of the hypothesis testing reported here. The decision not to analyze them as outcome measures reflects the study's main focus on perceived pedagogical value rather than direct changes in participants' science knowledge.

Intervention Materials and Procedure

The intervention consisted of a structured 30-minute video session conducted in Arabic. Four short videos were produced by the research team, one for chemistry, one for physics, one for biology, and one for technology. Each video lasted approximately 5 to 7 minutes and was designed around a familiar everyday situation. The chemistry video focused on household and food-related transformations such as rusting, cleaning agents, and acid-base interactions in cooking. The physics video used movement, transport, and energy transfer in ordinary routines such as cycling and braking. The biology video connected digestion, respiration, exercise, and everyday health practices to underlying body processes. The technology video addressed sensors, algorithms, and smart devices used in common digital environments. Across all four videos, narration and visuals explicitly highlighted why a teacher might use the context, what scientific idea it could open, and how it might support participation, questioning, and understanding. **Table 3** presents the intervention materials, and **Figure 1** summarizes the study sequence.



Figure 1. Study sequence for the video-based modeling intervention (created by the authors)

The intervention was intentionally designed as modeled pedagogy rather than content delivery alone. Each video followed a similar internal sequence. It opened with a recognizable everyday situation, named the underlying scientific idea, and then returned to the situation to show how the concept clarifies what is happening. The videos also included teacher-oriented prompts such as possible student questions, likely misconceptions, and brief suggestions for extending the example into classroom dialogue. This design drew on the premise that professional learning is more effective when teachers see an instructional move in action rather than simply hear that a strategy is desirable (Kong & Lin, 2024; Martins & Baptista, 2024). The materials were not meant to function as finished lessons; instead, they served as compact demonstrations of how relevance can be built without sacrificing disciplinary focus.

Data collection unfolded in three stages. During the pre-test stage, participants received a short explanation of the study, signed informed-consent forms, and completed the demographic form and the perception questionnaire. During the intervention stage, participants viewed the four videos in a supervised session. Brief pauses between videos allowed them to record short reflections and note possible classroom uses, but there was no extended discussion that could confound the intervention. During the post-test stage, administered one week later under the same conditions, participants completed the perception questionnaire again. The one-week interval was chosen to reduce immediate response inflation while still capturing short-term perceptual change attributable to the modeled materials.

Ethical Considerations

The study received institutional approval from the participating college of education (ethics approval no. 2024-45). Participation was voluntary. All respondents were assured that the data would be used only for research purposes, that no identifying information would appear in publications, and that withdrawal was possible at any stage without consequence.

Data Analysis

Quantitative analyses were conducted in IBM SPSS statistics 30. Data were screened for completeness and assumption checking before inferential analysis. Because all participants completed both administrations, the repeated-measures dataset contained no missing matched cases. Descriptive statistics and reliability coefficients were calculated first. To address **H1**, Pearson correlations were computed among the three perceived student outcomes, engagement, interest and curiosity, and achievement, within each science subject domain and at each time point. To address **H2** to **H4**, 2×2 mixed ANOVAs were conducted for each dependent variable within each subject domain, with group, in-service vs. pre-service, as the between-subjects factor and time, pre-test vs. post-test, as the within-subjects factor. Independent-samples comparisons were inspected descriptively through the group *M*s. Effect sizes for ANOVA results are reported as partial eta squared. With only two repeated measurements, the sphericity assumption was automatically satisfied.

RESULTS

Preliminary inspection showed that scale reliabilities remained high across the three questionnaire dimensions, supporting the internal coherence of the instrument at both administrations. The results below are organized by hypothesis and interpreted strictly as perceptions of likely student outcomes.

Perceived Relationships Among Engagement, Interest and Curiosity, and Achievement

Table 4 shows positive correlations among the three perceived outcomes in all four subject domains before and after the intervention. At pre-test, the correlations were already moderate and statistically significant. Participants who more strongly endorsed the idea that everyday-life integration would increase engagement also tended to view it as supportive of curiosity and achievement. The same pattern is held for

Table 4. Pearson correlations among perceived engagement, interest and curiosity, and achievement before and after the intervention

Subject	Pre: E-I/C	Pre: E-A	Pre: I/C-A	Post: E-I/C	Post: E-A	Post: I/C-A
Chemistry	.31*	.45**	.52**	.39**	.59***	.64***
Physics	.42*	.32*	.57***	.46**	.48**	.69***
Biology	.47**	.37*	.53**	.57***	.52**	.59**
Technology	.39*	.48**	.61***	.52**	.67***	.72***

Note. E: Engagement; I/C: Interest and curiosity; A: Achievement; *p < .05; **p < .01; ***p < .001

Table 5. Mixed ANOVA results for perceived effects of everyday-life integration on student engagement

Subject	Pre: in-service M (SD)	Pre: pre-service M (SD)	Post: in-service M (SD)	Post: pre-service M (SD)	F (1, 118)	η^2
Chemistry	3.45 (0.52)	3.25 (0.60)	4.10 (0.45)	3.85 (0.48)	12.34***	.28
Physics	3.50 (0.50)	3.30 (0.55)	4.15 (0.40)	3.90 (0.42)	13.65***	.30
Biology	3.60 (0.48)	3.35 (0.53)	4.20 (0.44)	3.95 (0.46)	15.89***	.32
Technology	3.55 (0.49)	3.40 (0.57)	4.25 (0.43)	3.95 (0.47)	14.45***	.31

Note. Values in the F column refer to the group $\times$ time interaction & ***p < .001

the relation between perceived curiosity and perceived achievement. The baseline pattern was therefore coherent rather than fragmented: participants generally understood these three outcomes as connected aspects of one pedagogical logic.

At post-test, the same correlations became stronger in every domain. The rise was especially clear for technology, where the engagement-achievement correlation increased from .48 to .67 and the curiosity-achievement correlation increased from .61 to .72. Chemistry showed a similar strengthening, with the engagement-achievement correlation increasing from .45 to .59 and the curiosity-achievement correlation increasing from .52 to .64. Although the changes were smaller in physics and biology, the direction was consistent. These results support **H1**. After viewing explicit models of how science can be linked to ordinary situations, participants appeared to hold a more integrated perception of the pathway from relevance to participation, from participation to curiosity, and from curiosity to achievement.

Perceived Effects on Student Engagement

Table 5 presents M scores for perceived effects on student engagement. Before the intervention, in-service teachers already reported somewhat more favorable views than pre-service teachers in all four domains. The difference was modest but stable, with pre-test Ms ranging from 3.45 to 3.60 for in-service teachers and from 3.25 to 3.40 for pre-service teachers. After the intervention, both groups reported higher scores in every domain. In-service teachers' post-test Ms ranged from 4.10 to 4.25, while pre-service teachers' Ms ranged from 3.85 to 3.95. The strongest post-test value appeared in technology for in-service teachers.

The mixed ANOVA results showed significant group $\times$ time interactions in chemistry, physics, biology, and technology, with F values ranging from 12.34 to 15.89 and partial eta squared values from .28 to .32. These are substantial effects for a brief intervention. The pattern indicates that perceptions became more favorable over time in both groups, while in-service teachers maintained a slight advantage. **H2** was therefore supported. The results suggest that contextual modeling strengthened participants' belief that everyday-life integration can invite more participation and classroom involvement, but they also imply that prior teaching experience may sharpen confidence in this claim.

Perceived Effects on Student Interest and Curiosity

Table 6 reports the same analysis for perceived interest and curiosity. The pattern closely resembled that found for engagement. At pre-test, in-service teachers again scored slightly higher than pre-service teachers across all domains. Post-test Ms increased substantially for both groups. In-service teachers reached values between 4.25 and 4.45, whereas pre-service teachers ranged from 4.05 to 4.20. The largest post-test M again appeared in technology, followed closely by biology.

All group $\times$ time interactions were statistically significant, with F values ranging from 14.78 to 17.44 and partial eta squared values from .30 to .35. The increase was strong for both groups, which suggests that the intervention effectively sharpened participants' sense that everyday-life connections can stimulate

Table 6. Mixed ANOVA results for perceived effects of everyday-life integration on student interest and curiosity

Subject	Pre: in-service M (SD)	Pre: pre-service M (SD)	Post: in-service M (SD)	Post: pre-service M (SD)	F (1, 118)	η^2
Chemistry	3.60 (0.55)	3.40 (0.60)	4.25 (0.48)	4.05 (0.52)	14.78***	.30
Physics	3.65 (0.50)	3.50 (0.58)	4.30 (0.45)	4.10 (0.50)	15.90***	.32
Biology	3.70 (0.53)	3.45 (0.57)	4.40 (0.47)	4.15 (0.49)	16.35***	.33
Technology	3.75 (0.54)	3.55 (0.61)	4.45 (0.46)	4.20 (0.50)	17.44***	.35

Note. Values in the F column refer to the group $\times$ time interaction & ***p < .001

Table 7. Mixed ANOVA results for perceived effects of everyday-life integration on student achievement

Subject	Pre: in-service M (SD)	Pre: pre-service M (SD)	Post: in-service M (SD)	Post: pre-service M (SD)	F (1, 118)	η^2
Chemistry	3.55 (0.50)	3.35 (0.58)	4.30 (0.46)	4.05 (0.50)	16.12***	.31
Physics	3.60 (0.52)	3.40 (0.60)	4.35 (0.44)	4.10 (0.48)	17.23***	.33
Biology	3.65 (0.49)	3.45 (0.57)	4.40 (0.45)	4.15 (0.47)	18.56***	.34
Technology	3.70 (0.54)	3.50 (0.61)	4.45 (0.43)	4.20 (0.49)	19.34***	.35

Note. Values in the F column refer to the group $\times$ time interaction & ***p < .001

questioning, attention, and curiosity. Yet the in-service group remained more positive overall. **H3** was supported. One plausible reading is that experienced teachers may be better able to imagine concrete moments in which a familiar context triggers student questions, whereas pre-service teachers may still see the principle as compelling but less fully tested.

Perceived Effects on Student Achievement

Table 7 presents results for perceived effects on student achievement. As with the previous dimensions, in-service teachers began with moderately favorable scores, between 3.55 and 3.70, and pre-service teachers began slightly lower, between 3.35 and 3.50. After the intervention, both groups moved clearly into the agreement range. In-service teachers' Ms rose to 4.30 to 4.45, and pre-service teachers' Ms rose to 4.05 to 4.20. The strongest values again appeared in technology and biology.

The group $\times$ time interactions were significant in every subject domain, with F values ranging from 16.12 to 19.34 and partial eta squared values from .31 to .35. **H4** was therefore supported. The pattern is noteworthy because achievement is the strongest claim participants could make about the value of everyday-life integration, yet both groups reported sharper agreement after viewing the materials. Because the study did not include student performance data, the finding should be read as a change in pedagogical belief rather than as evidence of demonstrated learning gains. Even so, the result matters, since teachers are more likely to adopt an approach when they believe it can improve understanding and not merely increase interest.

The study also speaks to the relationship between affective and academic expectations in teachers' thinking. Much of the existing discussion treats engagement, curiosity, and achievement as separate outcome categories. The correlation pattern in this study suggests that participants did not think about them independently. They appeared to regard them as mutually reinforcing, especially after the intervention. This matters because it indicates that contextualized teaching was not viewed merely as a motivational add-on. Participants increasingly associated it with a fuller instructional sequence in which relevance invites participation, participation sustains curiosity, and curiosity supports understanding and performance. That integrated perception may help explain why context-based approaches are often valued even in systems where achievement pressures are strong.

DISCUSSION

The findings support a careful but meaningful conclusion. A brief, cross-disciplinary modeling intervention strengthened participants' perceptions that everyday-life integration in science teaching is associated with student engagement, curiosity, and achievement. The shift was visible in both groups, yet in-service teachers remained slightly more positive than pre-service teachers throughout. The intervention did not create an entirely new view. Rather, it consolidated and sharpened an existing orientation toward relevance. That distinction helps explain why pre-test correlations were already positive and why post-test changes were

strong but not dramatic. Participants entered the study predisposed to value real-life connections, and the intervention gave that predisposition clearer pedagogical form.

This interpretation is consistent with context-based science education research. Reviews and conceptual analyses have repeatedly argued that everyday situations can provide an entry point through which scientific ideas become intelligible and worth learning (Bennett et al., 2007; Gilbert, 2006; Pilot & Bulte, 2006). Empirical work on project-based science has also shown that students' prior knowledge and everyday experience can support understanding when teachers use context to organize inquiry rather than to decorate instruction (Rivet & Krajcik, 2008). More recent studies have extended that logic to scientific literacy, sustainability, integrated STEM, and socially situated science learning (Bossér, 2024; Okada, 2024; Puspita et al., 2024; Tan & Wei, 2024). The present study does not demonstrate student learning directly. It examines how teachers and pre-service teachers perceive the instructional value of context-based teaching, with emphasis on engagement, curiosity, and achievement as perceived outcomes. It shows that when teachers and pre-service teachers encounter the same concrete exemplars, their perceived map of pedagogical consequences becomes more coherent. Beyond the increase in M scores, the intervention was associated with stronger perceived links among relevance, participation, curiosity, and achievement.

The group differences also merit attention. In-service teachers consistently reported somewhat stronger perceptions than pre-service teachers. This aligns with research showing that professional experience mediates how educators interpret innovative approaches, whether in STEM integration, student-centered teaching, or the use of active methodologies (Kong & Lin, 2024; Martins & Baptista, 2024; Tan & Wei, 2024). Experience does not automatically make teachers more innovative, but it can make them more precise in judging when a strategy is likely to work. Pre-service teachers in this study were positive at both time points, yet their scores suggest a more tentative endorsement. That is unsurprising. They have had fewer opportunities to see whether a familiar context actually changes the tenor of a lesson, elicits better questions, or stabilizes understanding over time.

The subject-specific pattern is also informative. Technology produced the highest post-test Ms and the strongest post-test correlations, while biology was usually close behind. Chemistry and physics also showed robust gains, but their starting points were sometimes lower or their increases more moderate. One plausible explanation is that the affordances of everyday-life integration are more immediately visible when students can recognize the context in a device, digital routine, health practice, or bodily process. This does not mean that chemistry or physics are less suitable for contextualization. On the contrary, studies of chemistry education, energy-related reasoning, practical work, and STEM teaching suggest that abstract domains can benefit greatly from real-world framing when the pedagogical bridge is carefully designed (Bennett et al., 2007; Fitriyana et al., 2024; Vargas et al., 2024). The present results suggest that teachers may need especially persuasive exemplars in the more abstract domains in order to translate the principle of relevance into a vivid teaching possibility.

These results have implications for teacher education and professional development. Programs that ask teachers merely to endorse relevance at the level of principle may not go far enough. Participants in this study responded to materials that made the instructional move visible, concise, and transferable. That kind of modeling seems especially valuable in pre-service contexts, where abstract endorsement often precedes practical confidence (Biber & Saralar-Aras, 2024; Bybee, 2013). It is equally useful in in-service contexts, where teachers may already value contextualization but need fresh examples that connect relevance to disciplinary clarity and classroom feasibility (Altıntaş et al., 2024; Martins & Baptista, 2024). Short media-based exemplars are not a substitute for extended practice, lesson rehearsal, or classroom coaching, but they may be an efficient first step in changing how teachers appraise an instructional approach.

The contribution of the study lies in its comparative design, which brings together career stage, subject domain, and short-term perceptual change within one framework. The findings add context-specific evidence to the literature on relevance in science education by tracing perceptual change across career stage and subject domain, using a design that compares career stage, subject domain, and pre-post attitudinal change within a single intervention. That is modest, but not trivial. Science education research often relies either on broad claims about contextualized teaching or on student-centered outcomes without careful attention to the teachers who must enact the pedagogy. By centering teachers' and pre-service teachers' perceptions in

the same design, the study helps specify the attitudinal conditions under which context-based science teaching may be more readily implemented.

Positive findings in this area require careful interpretation, particularly when the instructional value of relevance may appear self-evident. In the present study, that issue was examined empirically through group comparison and pre-post change. The findings suggest that teachers and pre-service teachers do not necessarily organize engagement, curiosity, and achievement in identical ways, and that these perceptions become more closely aligned after targeted modeling. The data show that these perceptions are not only positive but structured, that they differ modestly by career stage, and that they become more tightly connected after a targeted intervention.

At the level of policy and program design, the findings support a relatively economical intervention logic. Large-scale reform efforts frequently assume that teachers will adopt relevance-oriented teaching once curricula or standards call for it. The present results suggest that adoption may also depend on whether teachers encounter credible micro-models of enactment. Colleges of education, induction programs, and school-based professional learning communities could use short, domain-specific media resources as prompts for lesson design, peer discussion, and rehearsal. Such resources are unlikely to transform practice by themselves, yet they may lower the threshold for experimentation by making the move from concept to enactment more visible. This is particularly important in settings where time, equipment, or access to extensive coaching is limited.

The regional focus of the study adds another layer to this contribution. In Arabic-speaking schools in northern Israel, everyday-life connections may support science teaching not only by increasing relevance but also by mediating between scientific terminology, school discourse, and community experience. A familiar context can help teachers introduce a term, stabilize its meaning, and connect it to a phenomenon that students can discuss in their own language before moving toward formal scientific wording. The results cannot be generalized automatically beyond this setting, yet they show why context-based pedagogy is especially worth studying in linguistically and culturally distinctive educational environments.

This bounded interpretation matters because it keeps the study's claims aligned with its evidence rather than allowing favorable perceptions to stand in for classroom effectiveness. The data show how teachers organize expectations about relevance after a shared model, not whether students would learn more in every possible classroom. That distinction makes the findings useful for teacher education, where beliefs often precede enactment but do not guarantee it. It also gives professional development designers a practical diagnostic point: before asking teachers to redesign lessons, programs should examine whether teachers can see how context, inquiry, and conceptual explanation can operate together. When that perception is weak, everyday examples may remain peripheral; when it is stronger, teachers may treat the example as the opening of a scientific problem. The intervention tested that perceptual shift in a concise form, across several subject domains and across two career stages. Its value lies in that specification, not in any claim that short videos alone can replace sustained mentoring, curriculum planning, or classroom observation. For this reason, the findings are best read as evidence about readiness for context-based enactment. They identify a promising starting point for subsequent studies that follow teachers from perception, to lesson design, to observed practice, and then to student learning. Such a sequence would extend the present results while preserving the evidential caution required by the design. This framing preserves methodological restraint while clarifying the practical relevance of the findings.

Limitations and Future Research

Several limitations frame the interpretation of the findings. First, the sample was a convenience sample drawn from one regional and sociocultural context, which limits generalizability. Second, the intervention was brief and involved a single modeled session rather than sustained pedagogical work. Third, the data are self-reported and concern perceived effects on students rather than direct observations of classroom practice or actual student outcomes. Fourth, without a control group, causal claims must remain restrained. Fifth, the instrument was researcher-developed, and although expert review, translation and back-translation, piloting, and reliability analysis supported its use, further validation with larger and more diverse samples is needed. This limitation is important because attitude and perception measures can be overinterpreted when their constructs are defined too broadly (Osborne et al., 2003; Vargas et al., 2024). Future research would benefit

from longer interventions, classroom observation, student-level measures, and follow-up designs that examine whether pre-service teachers retain these perceptions once they begin teaching. Cross-context comparisons would also be valuable, especially across programs that already emphasize integrated STEM, sustainability, or context-based curricula.

CONCLUSION

Everyday-life integration in science teaching is often endorsed rhetorically, but teachers still need to see how it can work within specific disciplinary lessons. The study shows that a short video intervention can strengthen teachers' perceptions that such integration supports engagement, curiosity, and achievement. In-service teachers remained somewhat more positive than pre-service teachers, suggesting that experience deepens confidence in contextualized teaching. The strong post-test gains suggest that modeled examples can translate a pedagogical ideal into a credible teaching strategy. In teacher education and professional development alike, the practical lesson is clear: relevance becomes persuasive when it is made concrete in classroom practice.

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