frontiers in Education

TYPE Original Research
PUBLISHED 05 August 2026
DOI 10.3389/feduc.2026.1891741

OPEN ACCESS

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RECEIVED 26 May 2026
REVISED 17 July 2026
ACCEPTED 22 July 2026
PUBLISHED 05 August 2026

CITATION
Gladow V and Buhl HM (2026) Partner models of explainers: a qualitative interview study.
Front. Educ. 11:1891741.
doi: 10.3389/feduc.2026.1891741

Partner models of explainers: a qualitative interview study

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Explanations are frequent interactional phenomena in educational and further professional settings. Constructivist instructional approaches emphasize that effective explanations must be adapted to learners' individual characteristics. This requires that explainers form an adequate mental "partner model" of their audience. This study investigates which dimensions of such models are considered particularly important when explaining. We conducted 26 semi-structured interviews with professionals who regularly explain complex content: schoolteachers, university lecturers, and physicians. A qualitative content analysis was based on five literature-based (deductive) categories identified as key partner model dimensions: explainees' Understanding, Prior Knowledge, Interest, Emotions, and Engagement. These were complemented by the inductively derived categories of Skills & Abilities and Agency. To address how the central dimension Understanding was associated with the other dimensions relational analyses were conducted. Strong associations emerged particularly with Skills & Abilities and Engagement. The findings highlight how experienced explainers actively consider multiple dimensions of their audience when explaining and suggest that considerations of Understanding are tightly linked to other dimensions as prerequisites and outcomes. Implications for teacher education and digital learning tools designed to foster adaptive explanation skills are discussed.

KEYWORDS
content analysis, explainee, explainer, explanation, learning, partner model, social cognition, understanding

1 Introduction

A widespread activity in educational settings is explaining. Teachers, tutors, and university lecturers explain to students and tutees. How well this works depends on their successful adaptation of the explanation to the characteristics of the explainees (e.g., Chi et al., 2001; Kulgemeyer, 2018 Parsons et al., 2018). Personalized teaching requires assessing individual student needs rather than relying on a one-size-fits-all approach (Bernacki et al., 2021). Therefore, teachers need appropriate mental representations of their students' prior knowledge, interests, emotions, and more—so-called "partner models" (e.g., Brennan et al., 2010). While the need to adapt to the partner—and thus to hold a partner model—is well established, little research has examined which dimensions of partner models are considered important by explainers. While prior knowledge and interest are frequently mentioned in the literature, less is known about other dimensions. Thus, our research question is: Which dimensions of partner models do experienced explainers explicitly report taking into account? To address this question, we carried out a qualitative study based on the literature outlined in the

following. In explanations, the explainees' understanding plays a crucial role. Our second research question therefore focuses on the dimensions of the partner model that are particularly closely related to understanding.

The conceptualization of partner models has gained increasing attention in contemporary educational research. Constructivist instructional approaches emphasize that the learner/tutee etc.—generalized the "explainees"—and their characteristics influence the explanation and must be taken into account by the explainer (Geelan, 2013; Kulgemeier and Geelan, 2018; Lachner and Nückles, 2016; Wittwer and Renkl, 2008). Teachers' adaptivity to students' characteristics and purposes stimulates instruction and tutoring (Chi et al., 2001; Kulgemeyer, 2018; Parsons et al., 2018). An important condition for teachers' adaptivity to students' individual needs is their appropriate mental representations of their students concerning their prior knowledge, reasoning abilities, interests, current motivation, emotions, etc. As research on tutoring has shown, explanations result in better understanding if they are adaptive and consider the learners' characteristics, especially prior knowledge, skills, or cognitive abilities (Wittwer and Renkl, 2008). Directing tutors towards tutees' prior knowledge reduced tutees' misunderstanding and supported their knowledge acquisition (Nückles et al., 2005).

Informed by social and cognitive psychology as well as psycholinguistics, these mental representations are summarized as "partner models" (e.g., Brennan et al., 2010; Dillenbourg et al., 2016). They were introduced in the research context of establishing common ground between interlocutors (e.g., Clark and Brennan, 1991; Fischer, 2016). Examining the role of partner models in dialogues, particularly in explanations, reveals that they do not necessarily need to be comprehensive. (Brennan et al. 2010, p. 324) emphasize that not "all knowledge" about the partner must be represented. Thus, it remains an open question which specific dimensions of the partner model are considered by explainers.

When analysing the psychological foundations of joint learning, (Dillenbourg et al. 2016, p. 230) introduced an important distinction between two categories of partner model dimensions: dispositional and situational dimensions. The former refers to "permanent knowledge bases, abilities or personality characteristics", whereas the latter encompasses "knowledge, behaviours or intentions that become relevant within the current cooperative situation between partners A and B" and thus have only temporary significance.

In addition, the current state of the literature provides evidence for specific dimensions. The most important (situational) dimension is the explainee's ongoing understanding. Explanations are typically given with the aim that the explainee comprehends new content. The explanation must therefore be fundamentally adapted to this understanding. Unlike other partner model dimensions, understanding develops and increases over the course of the explanatory dialogue. The explainer must monitor this increase in understanding as well as phases and aspects of non-understanding, and adapt the explanation accordingly (Kulgemeyer and Geelan, 2018; Lazarov et al., 2024; Rohlfing et al., 2021). Thus, understanding is a crucial part of the partner model. In this empirical study, we will analyse how understanding relates to other dimensions of explainers' partner models.

Whereas "understanding" is defined as the knowledge resulting from an explanation (Buschmeier et al., 2025), explainers also consider the explainees' prior knowledge. Furthermore, beliefs, attitudes, interests, and emotions are regarded as essential components both in the classroom (Frenzel et al., 2009) and within the partner model (Thommes et al., 2024).

Currently, partner models are also an emerging topic in interactions with digital tools and especially artificial intelligence (Miller, 2019; Schmid and Wrede, 2022). Doyle et al., 2021 identified three main factors in the perception of speech interfaces: their competence, cognitive flexibility, and human-likeness. The latter is, of course, not relevant in human-human interactions. Competence encompasses aspects of knowledge (e.g., expertise) and dialogical competence (e.g., reliability, preciseness). Focusing on explanations provided by AI systems to human explainees, Robrecht and Kopp, 2023 considered explainees' expertise, attentiveness (not to be distracted), and cooperation.

To sum up, we identify frequently addressed key dimensions of partner models that can be assumed to be relevant for explainers. Taking into account the dimensions most frequently referred to in the literature we expected that explainers mention the explainees'

- Understanding in the course of the explanatory dialog,
- Knowledge,
- Interest/motivation,
- Mood/emotions, and
- Engagement.

As a starting point for our analysis, we use "engagement" as an umbrella term for the vague and overlapping concepts of engagement, cooperation, and attentiveness.

The present study addresses two successive research questions:

First, we examine which dimensions of partner models are reported by professional explainers, using the dimensions identified in the literature as broad deductive categories in an initial coding process. Additional categories can be derived inductively to capture further frequently mentioned dimensions and refinements of the deductive categories. Second, building on this analysis, we investigate how these dimensions relate to the central dimension of understanding in the explainers' statements. This approach provides insight into which characteristics of explainees explainers consider to be associated with their understanding, including both prerequisites and outcomes of understanding.

2 Materials and methods

The present study used a qualitative, exploratory analysis based on semi-structured interviews with explainers who regularly engage in explanatory activities as part of their professional practice.

2.1 Sample

At the core of our study were interviews with explainers from educational settings, particularly school teachers. Before prospective teachers in Germany are allowed to teach students professionally, they must complete several mandatory phases of guided practice as part of and following a university degree program specifically designed for teacher training. These mandatory guided practice phases comprise, for example, six-week internships during the bachelor's program, the practical semester within the master's program, and the 12-month teaching internship immediately following graduation.

Given the extensive phases of guided practice and related assignments, it can therefore be assumed that teachers have learned how to explain effectively and how to adapt their explanations to the needs of their students. In contrast, findings from empirical studies suggest that prospective teachers and tutors experience difficulties in explaining concepts coherently and tailoring their explanations to students' understanding or knowledge (Findeisen and Seifried 2023). However, it is also conceivable that teachers report taking into account the instructional cues learned about their students (e.g., prior knowledge, developmental level, misconceptions), rather than relying on their own explanatory routines and flexible mental representations of their students' needs and prerequisites (Kulgemeyer and Tomczyszyn, 2015; Lachner and Nückles, 2016; Wittwer and Renkl, 2008).

To allow for comparison, we also interviewed university lecturers, who are generally less formally trained in didactics, but often took courses in higher education teaching methods. As a third group, we included physicians—professionals who also explain frequently, for example, in patient consultations, but who typically receive only limited and more incidental training in explanatory communication. Thus, the sample consisted of three professional groups characterized by regular engagement in explanatory activities within their everyday work contexts, which differ in their training background: primary school teachers, university lecturers, and physicians.

Participants were recruited through personal contacts and via snowball sampling, whereby existing participants referred additional individuals. An invitation via e-mail provided a brief description of the research project and asked recipients to take part in an interview on explanatory practices in their professional context. Interviews were conducted either online (via Zoom) or in person at Paderborn University, depending on participants' preferences. In total, 26 semi-structured interviews were conducted between 2021 and 2024.

Participants ranged in age from 25 to 64 years ($M = 44.69$, $SD = 13.31$). The sample comprised 10 physicians, 8 university lecturers, and 8 primary school teachers. Primary school teachers reported teaching in physical education, art, religious education, German, mathematics, and general science. University lecturers represented the disciplines of physics, psychology, electrical engineering, and German philology. Physicians were specialized in internal medicine, neurology, dentistry, trauma surgery, and orthopedics. An overview of the sample by professional group is provided in Table 1.

2.2 Procedure and instruments

2.2.1 Interview

Semi-structured interviews were conducted by three experienced interviewers. Prior to participation, interviewees received standardized information about the study's aims, the voluntary nature of participation, and their right to withdraw at any time without providing reasons. After the participants were greeted, informed and gave consent to the participation by signing the consent form, the interviews were proceeded according to the semi-structured interview guide. Mean interview durations per group are reported in Table 1.

The interview guide was divided into two parts and concluded with demographic questions. The first part of the interview guide focused on the interaction between the explainer and the explainee within the professional domains of the explainers and consisted of seven open-ended key questions. Sub-questions were optionally used to maintain the conversational flow. In the beginning, the explainers were asked to recall and describe the process of their latest professional explanation. The second question asked the interviewees to share their ideas of an optimal explanation process. They were also asked about how they had assessed the explainees' understanding during the explanation, how they had prepared for the lesson/lecture/informed consent consultation, and how the behaviour or statements of the explainees had influenced their explanatory approach when an explanatory dialog took an unexpected turn.

In the second part of the interview, explainers responded to four open-ended questions regarding their explanatory approach

TABLE 1 Sample characteristics grouped by interviewees profession.

Characteristics	School teachers ($n = 8$)	University lecturers ($n = 8$)	Physicians ($n = 10$)
Gender (female in %)	87.5	62.5	40
Age range in years	29–59 ($M = 48.8$; $SD = 11.64$)	29–59 ($M = 45.75$; $SD = 15.42$)	29–59 ($M = 48.8$; $SD = 11.64$)
Professional experience range in years	1.5–35 ($M = 21.65$; $SD = 12.57$)	1–35—($M = 13.43$; $SD = 13.32$)	1.5–35 ($M = 21.65$; $SD = 12.57$)
Interview duration range (minutes: seconds)	11:22–23:35 ($M = 17:34$; $SD = 1:08$)	16:45–54:18 ($M = 31:50$; $SD = 5:38$)	22:28 –73:29 ($M = 42:46$; $SD = 10:10$)

$N = 26$.

being influenced by their domain knowledge. As in the first part, subordinate follow-up questions were integrated for each key question depending on the flow of the interview. The interviewees were asked to report what was generally important to them when explaining, what goals they had set for themselves before an explanation, whether they followed a specific scheme or structure when explaining, and under what circumstances they deviated from that scheme. With the last question of the second part the interviewees were asked to what extent their impression of the explainees before the explanation had changed compared to their impression afterwards. The interview guides are provided in the Supplementary Material.

2.2.2 Data analysis

Interviews were audio-recorded, transcribed verbatim, and analyzed according to the seven-phase content-structuring qualitative content analysis approach described by Kuckartz and Rädiker (2024). This methodological framework supports the integration of deductive and inductive category development: The analysis is guided by dimensions derived from the literature while remaining open to additional dimensions that emerge from explainers' accounts. All analyses were conducted with computer assistance using MAXQDA (Analytics Pro 2022–2025; VERBI Software 2025).

An initial coding scheme comprised the five broad deductive categories reflecting partner-model dimensions derived from the literature (see above). In an initial coding cycle, all interviews were coded using these main categories by assigning relevant text segments to the corresponding categories.

Coding rules specified that only passages in which explainers referred to explainees' characteristics and related aspects of the explanation process were coded. Each coded segment had to constitute a sense unit (i.e., be understandable without relying on surrounding text) (Kuckartz and Rädiker, 2024). At minimum, one complete sentence was coded; when a sense unit extended across multiple sentences or paragraphs, it was coded as a single coherent segment. References to explainees' characteristics not covered by the five deductive categories were provisionally coded as "Other."

Following this initial cycle, we further examined the coded material to develop a more differentiated category system capturing the partner model dimensions that explainers appeared to consider while explaining. Within each interview, the coded segments assigned to each deductive category were thematically clustered to identify candidate dimensions emerging from the data.

Based on these clusters, the first author inductively defined main categories and subcategories to develop a preliminary differentiated category system. This system included both the main categories derived deductively from literature and the inductive main categories and subcategories derived from the data. After the eighth interview, no additional candidate main categories or subcategories emerged from the thematically clustered coded segments.

To test the differentiated category system, the first author and a research assistant coded seven interviews again using the differentiated category system. Subsequently, segment-specific agreement between the two coders was determined.

Based on a 90% threshold for overlapping coded segments, intercoder reliability was calculated using Brennan and Prediger, 1981 kappa ($\kappa = 0.82$), indicating a good to excellent level of agreement. Following the assessment of intercoder reliability, disagreements regarding coded segments were discussed until consensus was reached and the category definitions were jointly refined before coding the entire set of interviews.

Coding was performed on the German transcripts. The resulting categories were subsequently translated after the analysis into English for scholarly reporting. The illustrative excerpts in this paper were translated by the first author, with careful attention paid to maintaining semantic equivalence, proofread by a bilingual speaker.

3 Results

3.1 Dimensions of partner models

To address the first research question, i.e., which dimensions of partner models are identified by professional explainers, we report the categories derived from the qualitative content analysis. The following section provides a descriptive synthesis of the central characteristics for each category and includes selected interview excerpts to illustrate participants' accounts.

Source labels in parentheses after each excerpt indicate the participant's professional context, interview number, and transcript line number. Specifically, *EXL* denotes explainer primary school teacher, *EXU* explainer university lecturer, and *EXA* explainer physician. Interview numbers were assigned randomly and, in combination with the professional-group abbreviation, function as pseudonyms.

3.1.1 Understanding and Non-understanding

The deductive category "Understanding" was coded with reference to the explainees' understanding when dealing with the information emerging from the explanation. It encompasses the understanding of the explanandum, the individual steps within the explanation, and the statements made during the dialogue. After the initial coding process, it became apparent that many of the segments coded under Understanding actually related to instances of the explainees' lack of understanding or misunderstanding. Therefore, the Understanding category was expanded to include an inductively identified subcategory called "Non-Understanding". This category comprises segments that refer to the explainees' lack of understanding or misunderstanding when dealing with the information emerging from the explanation. Conceptually, understanding and non-understanding can be regarded as different manifestations of the same broader understanding-related dimension rather than as independent constructs. In the present analysis, however, Non-Understanding was retained as an inductively identified subcategory because interviewees explicitly referred to lack of understanding, misunderstanding, or difficulties in following the explanation, because these references played a distinct functional role: they often served as anchors for adapting, repeating, or redirecting the explanation. One primary School teacher stated for instance: *"If I realize that they haven't understood it at all,*

I would try a different approach or use an example, placing it under the document camera if necessary, so I would rely heavily on visuals and examples, rephrasing, and letting the pupils speak." (EXL05: 24).

Thus, Non-Understanding was not intended to constitute a separate partner-model dimension, but to capture an empirically salient and functionally meaningful manifestation within the broader dimension of explainees' understanding.

The majority of interviewees mentioned that they identified the explainees' misunderstanding or lack of understanding through the type and content of the questions the explainees asked during the explanation. However, it is perceived as a challenge to assess the understanding of the explainees in the explanatory process when they don't ask questions. For example, one lecturer said: "*But of course it is always possible in a limited form, because I would have to do a performance test at the end to be able to understand who has understood what and who has not. If there are no comments, I assume that it has been understood. I really ask and want to know whether everyone has understood. (..). And it's also important to me that they go out having understood it." (EXU03: 56)*. Understanding emerged as the most frequently coded category, with 224 coded segments. A total of additional 100 segments were coded under the Non-Understanding category. To prevent conceptual double-counting, coding was based on the dominant meaning of each segment. Segments were coded as Non-Understanding only when the lack of understanding, misunderstanding, or difficulty in following the explanation was explicitly addressed. References to successful comprehension or to ensuring that the explainee had understood were coded as Understanding. If a segment contained both aspects of understanding and non-understanding, and it was not possible to identify a specific focus between understanding and non-understanding because both aspects emerged equally within the segment, then both were coded. The situation in which understanding and non-understanding were coded together occurred in a total of only four segments.

Regarding the frequency distribution of the coded segments among the three professional groups of the interviewees, Understanding was coded most frequently in the physicians' group (89 coded segments) and least frequently in the primary school teachers' group (57 coded segments). Primary school teachers, on the other hand, referred more frequently to Non-Understanding (41 coded segments, 41% of the total coding) than the other groups (physicians with 36 coded segments, lecturers with 23 coded segments). Relative and absolute frequencies of the coded segments per category grouped by explainers' profession are displayed in Table 2.

3.1.2 Knowledge—prior knowledge—situational knowledge

For the initial coding process, "Knowledge" was used as a broad deductive category to code segments that referred to the knowledge of the explainees. The knowledge could have been more or less closely related to the explanandum. During the development of the differentiated category system, which included data-driven inductive categories in addition to the deductive categories, the Knowledge category was expanded to include "Prior knowledge" and "Situational knowledge" as inductive subcategories. In the second coding process, the segments coded under Knowledge could be completely structured into the subcategories.

Prior knowledge was coded if the interviewees referred to the knowledge the explainees had prior to the explanation, which served to build on further knowledge. This prior knowledge could either be broadly or specifically connected to the explanandum, i.e., introductory basic knowledge of an explanandum-related domain or knowledge of specific content instructed in previous lectures. For example, one primary school teacher interviewee reported that, as the explanation unfolds, the explainees "*begin to draw connections to topics they already know, especially in the area of religion or also in the area of*

TABLE 2 Absolute and relative code frequencies per category by explainers' profession.

Category	EXL (n = 8)		EXU (n = 8)		EXA (n = 10)		Total
	AF	RF (%)	AF	RF (%)	AF	RF (%)	AF
Understanding	57	25.4	78	34.8	89	39.7	224
Non-Understanding	41	41.0	23	23.0	36	36.0	100
Prior Knowledge	10	34.5	12	41.4	7	24.1	29
Situational Knowledge	19	22.6	25	29.8	40	47.6	84
Interest (Explanation)	5	16.1	11	35.5	15	48.4	31
Interest (Explanandum)	14	29.2	17	35.4	17	35.4	48
Mood & Emotions	2	28.6	1	14.3	4	57.1	7
Positive Mood & Emotions	4	19.0	5	23.8	12	57.1	21
Negative Mood & Emotions	9	8.7	17	16.5	77	74.8	103
Engagement	46	38.0	52	43.0	23	19.0	121
Skills & Abilities	31	27.9	19	17.1	61	47.6	111
Agency	6	14.6	11	26.8	24	58.8	41

AF, absolute frequency; RTF, relative frequency in percent; Interviewees grouped by profession; EXA, explainer physician; EXU, explainer university lecturer; EXL, explainer primary school teacher.

science." (EXL07: 18) One physician interviewee mentioned that a certain amount of prior knowledge on the part of the patient is a necessary basis for the patient to be able to ask specific questions during the informed consent consultation: "*Then you have a common basis that you can build on. Then the patient/ already has a certain amount of reasonable prior knowledge and can ask specific questions or you can work on this with the patient using these standardized information sheets." (EXA07: 24).* Another interviewee, a lecturer, referred to the prior knowledge they expected their students to have: "*I have an approximate idea of what prior knowledge they have or what prior knowledge they should have." (EXU07: 63).* A total of 29 segments were coded with "Prior knowledge".

The Situational knowledge category comprised 84 coded segments. This category was coded when the interviewees referred to the explainees' specific knowledge regarding the explanandum during the explanatory process. For example, one physician stated that: "*During the consultation I have to listen carefully to determine how much the patient can process, what the patient can understand, and what assumptions or misinformation they may have that I need to clarify first. Of course, I respond to the patient's utterances and then have to modify my explanation accordingly." (EXA05: 64).* While a lecturer interviewee was recounting the course of their previous explanation, they implicitly mentioned inferring their students' situational knowledge from a question posed by the student: "*Then he said to me, 'But what about 'ziehen' and 'zog'? The vowel alternates there.' And then I said, 'That's a deeper question, someone has already been able to grasp the whole thing and is now going one step further.' Then I get the feeling that this person has REALLY worked it out and is actually asking a question that shows me that it goes beyond what I initially intended." (EXU08: 34).*

An example that illustrates the distinction made by interviewees between these two knowledge dimensions may be the following interview quote, where a lecturer reported noticing what knowledge the explainees were lacking based on their questions: "*I often notice from the type of question what might be lacking. Not just lacking in what I have just explained, but possibly also lacking in some of the basics." (EXU07: 59).*

3.1.3 Interest and motivation—interest (explanation)—interest (explanandum)

Although interest as a partner model dimension in the literature referred to the interest in the explanandum, the deductive category "Interest" was broadened to include any mentioning of the explainees' interest by the interviewees in the initial coding process. In examining the interview data, it became apparent that the interviewees differentiated between the interest in the explanandum and the interest in the explanation. As a result, the category "Interest & Motivation" was divided into the categories "Interest (explanandum)" and "Interest (explanation)".

Interest (explanation) was coded when interviewees referred to the explainees' interest in the explanation. This interest relates to aspects of the explanatory process regarding the interaction between explainer and explainee. For example, one interviewee reported that they deviated from their explanatory approach according to the perceived interest of the explainee in the explanation: *"I deviate from the approach when I notice that the student is not interested in a detailed explanation." (EXU04: 149).*

References to the explainees' interest in the content being explained were coded with the Interest (explanandum) category. A physician interviewee, for example, mentioned the explainees' interest in the complications being explained during the informed consent consultation: "*Especially complications, i.e., what can happen—some patients also really are interested in knowing this." (EXA08: 66).* One interviewee, a lecturer, said that they keep the explanation shorter in order to be aware of their resources when they notice that the student is not really interested in what is being explained: "*And I don't spend half an hour explaining something to someone who doesn't really want to know." (EXU02: 109).*

A total of 31 segments were coded with Interest (explanation). This category was most frequently coded in the physician group (15 coded segments) and less frequently coded in the primary school teacher group (5 coded segments). With Interest (explanandum), 48 segments were coded (17 coded segments in the physician and in the lecturer group, 14 coded segments in the primary school teacher group).

3.1.4 Mood & emotions—positive—negative

Segments that refer to the explainees' moods and emotions were coded under the general category "Mood & Emotions" in the initial coding process. In the further course of the analysis, this category was differentiated into the subcategories "Negative Mood & Emotions" and "Positive Mood & Emotions". Segments that could not be assigned a positive or negative valence remained coded under the main category Mood & Emotions. With a total of 103 coded segments, the Negative Mood & Emotions category was coded more frequently than the Positive Mood & Emotions category, under which 21 segments were coded. With the superordinate category Mood & Emotions, i.e., without valence assignment, 7 segments were coded.

The category Negative Mood & Emotions was coded most frequently in the interviews with the physicians, with 77 out of 103 coded segments (9 from primary school teachers, 17 from lecturers). The physician interviewees most frequently referred to the explainees' feelings of anxiety, with a variety of references: pain, complications, uncertainty, interventions, new or improved therapies, potentially serious diagnoses and their future consequences, as well as loss of function and role (EXA10: 46; EXA08: 34; EXA07: 10; EXA04: 20; EXA07: 36; EXA05: 80). Observable or physiological indications such as distress, high tension, increased blood pressure, a helpless look, and nervousness were mentioned as indicators that the interviewees use to identify the emotion (EXA09: 42; EXA08: 46; EXA07: 34). In addition, uncertainty, overwhelm, and confusion due to information overload or difficult-to-understand explanations (EXA08: 14; EXA04: 12), catastrophizing (EXA09: 50; EXA04: 18; EXA08: 46), skepticism and rejection (EXA09: 62; EXA04: 30; EXA07: 84), intransigence and reserve (EXA04: 30), hesitancy (EXA07: 10), emotional decompensation and breakdown (EXA09: 86), shock, sadness, and crying (EXA03: 28; EXA04: 18), helplessness and dependence (EXA07: 34), as well as concealed incomprehension out of politeness or shame

(EXA01: 27). Also listed were agitation and restlessness before or during clarification (EXA10: 94), emotional exceptional situations with aggressive or strongly sad reactions (EXA08: 52). In this context, the emotions relate to both the explanation and the explanandum, that is, the illness or upcoming surgery.

The university lecturer interviewees mentioned shyness and inhibitions when admitting non-understanding (EXU04: 44). They also mentioned questions that came across as aggressive or demanding (EXU04: 50; EXU04: 68), occasional anger (EXU04: 90), and general frustration (EXU01: 58). Restlessness as an indication of a need for clarification or exchange was also addressed (EXU09: 106; EXU03: 38). Other concerns mentioned included worries about upcoming practical phases (EXU03: 28) and perceived pressure (EXU06: 52).

The primary school teacher interviewees most frequently referred to recurring boredom among high-achieving or very fast learners (EXL04: 26; EXL08: 28; EXL06: 12; EXL01: 36). They described observable signs of passive or playful disengagement (EXL06: 12) as well as verbal references to a lack of challenge (EXL04: 26; EXL08: 28). In addition, uncertainty or lack of understanding (EXL02: 56) and frustration among individual pupils (EXL04: 28) were mentioned. Exam-related anxiety, tension, and worries occurred in situations prior to tests (EXL08: 24–26).

Regarding the Positive Mood & Emotions category, the same emotions and moods were mentioned by all three groups, namely satisfaction, joy, and relief. This category was most frequently coded in the physicians' group, with 12 out of 21 coded segments. Likewise, negations of positively or negatively associated emotions and moods were not assigned a valence, such as statements of this kind: "*So the patient roughly knows what it is about, that he is not afraid if possible." (EXA06: 16).* Or statements without specific valence of emotions and moods, such as this statement here: "*I very often have lively classes, in quiet classes, when I think of our fourth graders now, I can see in the children's faces and posture whether they switch off inside or not." (EXL07: 32).*

3.1.5 Engagement

The category "Engagement" was used to code statements by explainers about the engagement or involvement of explainees, as well as references to their cooperation in jointly shaping the explanatory process. The interviewees mentioned both positive and negative indicators regarding the engagement of the explainees.

Positive indicators included attentive listening, verbal contributions such as questions, answers, follow-up questions, the co-constructive contribution of their own knowledge, the active use or request for aids, and the formulation of independent strategies or optimization suggestions (EXL07: 4, 28; EXL08: 16, 38; EXU09: 38, 158; EXU03: 66, 86; EXU04: 30; EXL03: 52). In addition, visible attention such as eye contact and body posture, differentiated feedback to ensure understanding, in-depth technical exchange, and nonverbal signals such as nodding are among the positive indicators (EXL06: 14, 34; EXL08: 8, 40; EXU02: 107; EXU08: 38, 46; EXU07: 83).

Negative indicators relating to a lack of engagement, on the other hand, are determined by the explainers through distraction, passivity, or rejection. Examples of this include being loud, looking away, drifting off, hesitant or absent responses, lack of feedback despite requests, distracting media use, delayed basic questions, repetitive questioning, and lack of follow-up questions or low participation due to fatigue (EXL01: 36; EXU06: 28, 38, 66, 102, 157; EXU09: 124, 138; EXU08: 34, 48; EXL05: 18; EXA06: 54).

The university lecturers' interview group had the most coded segments in the Engagement category, with 52 segments. The primary school teachers' group had 46 segments coded in this category, while the physicians' group had 23 segments coded in this category.

3.1.6 Skills & abilities

"Skills & Abilities" is a category that was formed inductively from the material since they could be clearly distinguished from statements about the explainees' understanding or knowledge. The 111 coded segments are abstract attributions of skills and abilities that enable or limit options for action and do not necessarily relate to the explanandum. Attributed skills and abilities included, for example: high performance/ low learning ability, (poor) memory, (lack of) receptiveness, (lack of) basic anatomical knowledge, (lack of) cognitive decision-making ability, analphabetic, low level of education, low/high intelligence, inquisitive or well-educated.

For example, one physician interviewee referred to the language barrier of the patients as a challenge in the explanatory process: *"sometimes it's difficult when the language barrier is so great that I can actually only get a little information across." (EXA09: 26).*

Three primary school teachers differentiated in their interviews between generally high- and low-performing pupils (EXL05, EXL04, EXL08). Regarding assessing pupils' understanding, one primary school teacher, for example, reported: "*By having different students of varying performance levels explain it, sometimes not the same task, but always someone else. In certain cases, you may also call on the same student because they may have a special ability to explain things, or you may ask low-performing students explicitly: 'Did you understand that?'"(EXL05: 16).*

Another example could be a physics lecturer who reported to pay attention to the mathematical abilities of the explainees: *"In physics, we also have the possibility, perhaps someone is more adept at mathematics, or perhaps someone is not mathematically adept, so of course in physics, because this is a field where you have applications, you can either explain with an example, but if the example doesn't work, perhaps you can use mathematics."(EXU01: 70).*

In the physician group, it also became clear that certain skills and abilities were attributed to the explainees based on their profession or educational qualifications. For example, EXA01 reported his observation that explainees with a higher level of education have a more complex vocabulary and ask more detailed questions during the informed consent consultation. EXA03 bases the informed consent consultations on the patients' professions in order to illustrate the medical processes

metaphorically. EXA03 recounted the example of a mechanic, where they used a picture of an engine to illustrate the explanation. Overall, the interviewees described a variety of cognitive, linguistic, and domain-specific abilities and skills among the explainees, which, according to their attribution, were related to an adjustment of the explanatory approach.

3.1.7 Agency

The category "Agency" derived from the material. It was defined in accordance with Abele and Wojciszke (2007, p. 752) and (Abele et al. 2008, p.1204) and refers to an individual's drive for independence, control over their environment, and the expansion and protection of themselves. This relates to competence and initiating structure. Agency was understood as the explainee's capacity or willingness to act as an independent interlocutor in the explanatory situation, including active participation, autonomous decision-making, and, in some cases, deliberate refusal or delegation.

Segments coded under the category Agency reflected different positions on an agency-related continuum. They included descriptions of reduced agency, such as low self-efficacy, passivity, or resignation; descriptions of pronounced agency, such as active problem solving, proactive communication, critical questioning, and autonomous decision-making; and cases in which the observable behavior was interpretively ambiguous.

First, some segments described reduced agency, including low self-efficacy, passivity, resignation, or avoidance. For example, one primary school teacher told of a pupil who was cognitively disengaged in math's lessons because the pupil anticipated failure and was convinced that they would not be able to complete the tasks (EXL03: 26). One lecturer reported an explanatory situation with a student who initiated this explanation but was unable to articulate their problem and took an accusatory attitude toward them: *"Yesterday, one of my students called me and said: 'I can't do this.' And then I asked: 'Why not? There were two hours just now where supervisors were available who could have helped you.' And then he told me: 'Well, they just told me I should do it, and then it was already over.' I also thought, Okay, he didn't talk to me openly, so he couldn't tell me what the problem was. But the blame was also placed on others. It wasn't thought about: (..) 'What should I have done differently?'", and there was this accusatory attitude." (EXU04: 84–86).*

Interviewees from the physician group also described situations in which patients avoided dialogue or delegated the decision to the physician, for example by saying "just do it" (EXA07: 34) or on patients who rejected the explanation and were unreasonable (EXA4: 30). Such cases were treated cautiously because delegation may indicate reduced agency, for instance when accompanied by resignation, uncertainty, or avoidance, but may also reflect an autonomous preference not to receive further information or not to participate actively in the decision-making process. Therefore, these segments were interpreted as reduced agency only when the surrounding account framed the behavior as passive, resigned, or marked by low self-efficacy. Where such contextual indicators were absent, they were considered ambivalent rather than straightforward evidence of low agency.

Other coded segments, on the other hand, contain descriptions of pronounced agency through active problem solving, proactive communication, initiative in argumentation, and critical questioning. For example, one elementary school teacher reported how a student developed their own strategies, such as inventing an efficient folding technique before cutting (EXL03: 52), while another teacher reported on a pupil independently completing a task that had not yet been fully explained (EXL08: 40). The physicians interviewed described how patients express detailed questions, criticism, or accusations early on (EXA08: 82), use conversations to justify the necessity of a measure themselves (EXA05: 54), show a pronounced need for conversation (EXA08: 28), or temporarily take over the conversation (EXA01: 35). Interviewees from the lecturer group reported on agency in relation to critical questions and initiative in arguments: students engage in lively discussions, question content, contribute personal opinions, and offer criticism (EXU03: 88). They ask in-depth questions that go beyond the models provided and address deeper contexts (EXU02: 91).

Third, in the physician interviews, agency was also described in terms of autonomy and sovereign decision-making. The central goal of informed consent consultations is emphasized as informed, independent decision-making based on a clear understanding of the issues (EXA10: 70). A signature given freely, without external pressure, serves as proof of sovereign consent and autonomous agency (EXA08: 70). Autonomy also includes the legitimate rejection of proposed measures (EXA07: 46) and the informed refusal of medication after being informed of the risks (EXA03: 44). In these cases, resistance, rejection, or non-acceptance were not interpreted as low agency, but as possible expressions of autonomous self-determination when they were described as voluntary and informed.

To sum up, Table 2 displays the frequency distribution of the coded categories, i.e., the mentioned partner-model dimensions.

3.2 Relations between categories

The second research question built on the initial analysis. The objective was to explore how the identified dimensions of partner models relate to the central dimension of understanding. Due to the high frequency and relevance of the category "non-understanding" as expressed by the interviewees, a relational analysis was also carried out for non-understanding.

3.2.1 Understanding

To examine how the category "Understanding" relates to the other categories, a code co-occurrence segment matrix was generated using MAXQDA. This matrix functioned as an analytic filter by displaying all interview segments in which Understanding intersected with at least one additional category. This means that at least two categories were coded overlapping in one segment of the interviews; in other words, a segment was assigned, for example, the categories "Understanding" and "Engagement," so that these categories overlapped in that segment.

In total, Understanding co-occurred with other categories in 86 segments across the interview data. Figure 1 provides a

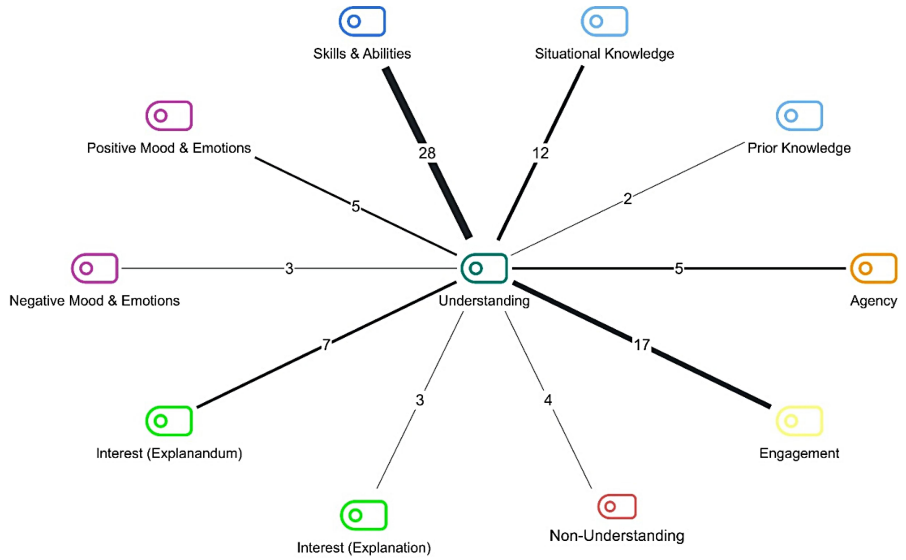

FIGURE 1
Co-occurrence model (code intersections with understanding).

visualization of the categories that co-occur with "Understanding," with the co-occurrence frequency displayed between the lines connecting the categories. The width of these lines is proportional to the frequency of co-occurance.

The most frequent co-occurrence was observed between Understanding and Skills & Abilities. These segments predominantly comprise statements in which explainers attribute relatively abstract, primarily cognitive abilities or constraints, such as processing capacity or comprehension skills, to explainees. In the interviewees' accounts, these attributed abilities appear to be treated as perceived conditions shaping how capable explainees are considered to be of understanding an explanation. Thus, the relation is not interpreted as an empirically established prerequisite of understanding, but as an explainer-side attribution regarding the perceived possibility or extent of understanding. As one interviewee noted: "Of course, the explanatory conversation also depends on how well the person concerned or the patient is able to understand things, for example." (EXA04:8). Moreover, explainers reported adapting their explanatory strategies in response to these attributed abilities. For example: "*Yes, of course, during the conversation I have to listen carefully to determine how much the patient can process, what the patient can understand, and what prior knowledge or misinformation they have that I need to clarify first. Naturally, I respond to the patient's comments and then have to modify my explanation accordingly.*" *(EXA05: 64)*.

Co-occurrences between Engagement and Understanding suggest that interviewees often framed explainees' active involvement as relevant for monitoring understanding during the explanatory process. In particular, interruptions, requests for clarification, and explicit feedback were described as possible cues through which explainers assess whether information has been understood. Importantly, such feedback is not only welcomed but, in some cases, explicitly expected by explainers, as reflected in the following statements: "*I want they to listen to me and interrupt me if they doesn't understand something*" *(EXA05:26)*, "*Yes, I have an expectation, namely the expectation that they will let me know whether they understand it that way, or whether I should explain it again in a different way*" *(EXU08: 38)*.

Looking at the segments that show overlaps between Situational Knowledge and Understanding, there are statements in which interviewees from the university lectures group and the primary school teacher group reported on their expectations regarding the scope of knowledge that the explainees are expected or not expected to understand in the explanations. For example: "*I can't expect that when I explain something big, a major topic, they will immediately grasp and understand EVERYTHING*" *(EXL01: 48)*

On the other hand, the interviewees reported interviewees reported using explainees' questions and contributions as cues for assessing which specific knowledge may already have been gained during the explanation process and which aspects explainees may be thinking about further. For example, one university lecturer reported on how drawing on further examples serves as an indicator for understanding the theories explained: "*I always give them the opportunity to find other examples besides the ones I've mentioned myself, because that's always a good indication that they've understood the theory I've explained and can apply it themselves.*" *(EXU03: 74)*

Regarding overlaps with Prior Knowledge, these are statements in which the interviewees EXL07 and EXA05 reported that the explainees link the new information they have understood in the explanatory dialogue to their prior knowledge.

Looking at the segments that contain overlaps between Interest (Explanation) and Understanding as well as between Interest (Explanandum) and Understanding, both dimensions of interest were associated with interviewees' assumptions about explainees' desire to understand and about whether the explanation should be deepened or continued. In these accounts, interest appears to be treated as a possible cue for the explainees' willingness to engage further with the explanation.

As the following two interview examples illustrates: "*So when I notice that they want to understand, I am persistent and stay until it is understood. Or until they suggest to me that they don't want to anymore." (EXU04: 76),* "*I try to explain the information as clearly as possible and then see how they react. Whether they want more, want to know more, want to know less, or don't want to know anything specific at all." (EXA09: 32).*

Statements from interviewees with an overlap between Positive Mood & Emotions and Understanding linked the satisfaction of the explainees to their understanding of what has been explained or their understanding at the end of the explanation. For instance, one university lecturer stated the following: *"And from that perspective, (..) the goal is for students to leave the lecture satisfied, having understood everything" (EXU06: 106).*

The statements in which Negative Mood & Emotions and Understanding overlap suggest that interviewees sometimes framed understanding as being associated with a reduction of negative emotions such as fear or uncertainty. One of the physician interviewees stated for example: *"On the one hand, if patients understand what is going to happen, they will be less afraid of the unknown." (EXA10: 98).*

The segments in which Agency and Understanding overlap contain statements in which interviewees framed understanding as a condition for autonomous action and informed decision-making. For example, one of the physicians reported that the goal of his explanations in informed consent consultations is: *"that they understand all aspects of this examination and can then decide: 'Do I want this examination or do I not want it?" (EXA10: 70).*

3.2.2 Non-understanding

To examine how the category Non-Understanding relates to the other categories, we again generated a code co-occurrence segment matrix in MAXQDA, following the procedure described at the beginning of the previous section. Across the interview dataset, Non-Understanding co-occurred with other categories in 65 segments**.**

Figure 2 visualizes these co-occurrences: connecting lines indicate co-occurring categories, the numbers on the lines represent co-occurrence frequencies, and line width is proportional to frequency.

Non-Understanding co-occurred most frequently with Engagement (16 segments). The content of these segments suggests two recurrent ways in which interviewees linked engagement and non-understanding.

First, interviewees described an explicit expectation that explainees should signal non-understanding proactively, for example by asking questions or interrupting the explanatory sequence as soon as something is unclear: *"And then I expect that if they can't do it and don't understand, they will reach out and ask again." (EXU09: 122).*

Second, interviewees described low or declining engagement as a potential cue from which they inferred non-understanding. A university lecturer, for instance, reported: *"And then I noticed that in the first example (clears throat), engagement was really low. And that's when I realized, 'Okay, they don't understand this model yet.'" (EXU02: 43).* Similarly, a primary school teacher noted that non-understanding may become apparent when students disengage from the explanatory activity and attend to something else rather than seeking clarification: "*Yes, not understanding, clearly, when they ask questions or when you notice that one of them is somehow. With some children, for example, it manifests itself in the fact that they simply do something else. So they don't ask questions, but they are busy with something else. Or they stare at their sheet of paper for hours." (EXL04: 22).*

Segments coded at the intersection of Skills & Abilities and Non-Understanding comprise statements in which interviewees associated non-understanding with perceived abilities or constraints on the explainees' side. One recurrent prerequisite concerns the language level, which can lead to barriers in the

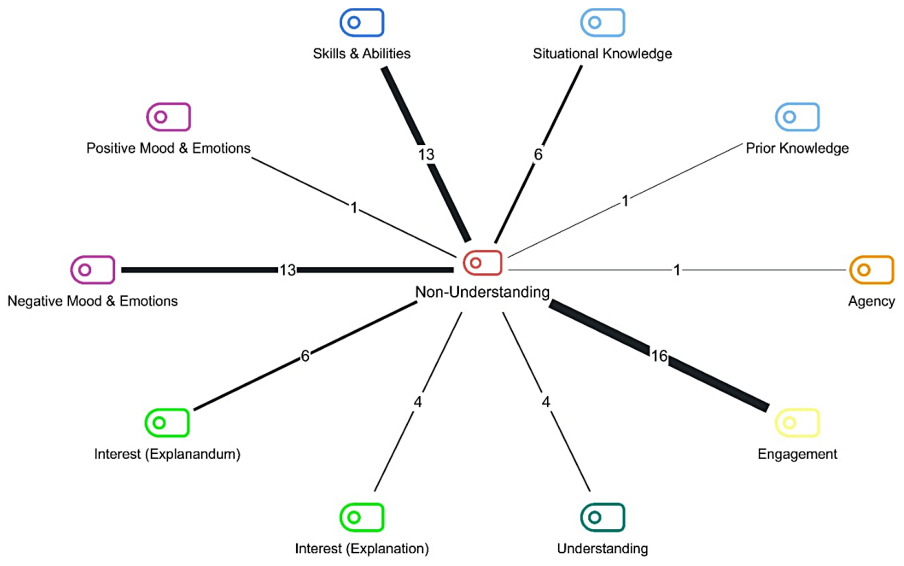

FIGURE 2
Code Co-occurrence model (code intersections with Non-understanding).

explanatory process. For example, one of the physicians reported: *"So there's always an exception, sort of, when I'm confronted with people who don't speak German or English well enough (..) I just come up against barriers that I eventually accept, where I have to say, okay, no, I'll explain everything anyway, but I have to accept that some of the information won't get across." (EXA09: 72).*

In addition, interviewees referred, at a vague level, to explainees' intellectual capacities and corresponding limits to what can be understood within an explanation. For example, one physician stated: *"Well, sometimes you get the impression that, um, no matter how much you tell them, they don't really understand the implications. [..] I mean, of course you can talk about something for hours, um (..) but some people just don't have the horizons, um, let's say, to understand every last detail." (EXA08: 44).*

Examining segments in which Interest (explanation) or Interest (explanandum) overlaps with Non-Understanding, suggests that. attributions of lack of interest and non-understanding were closely related in some accounts and were sometimes construed as competing interpretations of the same observable behavior. For example, one primary school teacher reported that they interpret students sitting around bored as either an indication of non-understanding or a lack of interest: *"If a student is just sitting around bored, maybe playing with a pen or something, then I know that either they haven't understood it or maybe it's just not interesting enough." (EXL06:12).*

Another example illustrating the closeness of the attributions of Non-Understanding and lack of interest is the following, in which one of the physicians interviewed concluded that some explainees sometimes do not understand the explained information because they don't want to hear it: *"Sometimes (uncomprehensible) it frustrates me, as I mentioned earlier, when I think to myself, you explained it clearly, so why don't they get it? I find that annoying (laughs). But yes, sometimes it may be that people don't want to hear what you're saying. That's important." (EXA03: 46).*

On the other hand, some interviewees associated a perceived lack of interest in the explanandum with a reduced willingness to engage in understanding, which, in their accounts, could lead them to shorten or not further elaborate the explanation. One physician describes this tendency as follows: *"Um, then sometimes you're inclined to think: 'Oh come on, um (..) you don't need to elaborate here, he doesn't want to hear that much, he just wants it to be over,' something like that." (EXA08:30).*

The segments in which Negative Mood & Emotions and Non-Understanding co-occur, indicated on the one hand that non-understanding was described by some interviewees as potentially leading to negative emotions. For example, one of the physicians emphasized the importance of the explainees understanding the content explained in the consultation in order to avoid experiencing fear, feelings of being overwhelmed, or taking a defensive stance: *"It's important to alleviate the patient's fears. For me, that's a very important factor in explanation, because a lack of understanding leads to fear, feelings of being overwhelmed, or even defensiveness." (EXA04: 12).*

In addition to fear, frustration was also mentioned in relation to negative emotions accompanying a lack of understanding. This is illustrated by one of the primary school teachers interviewed, stating: *"Well, if someone is really frustrated or something like that, then I try to calm them down again and really explain the basics again, and then I try to get the student to say, 'Okay, where exactly are you having trouble?' Where did they not understand? I try to find that out again by asking questions or prompting them." (EXL04: 28).*

On the other hand, within this intersection, some interviewees reported that explainees seemed reluctant to admit that they did not understand something during the explanations, illustrated by the following two excerpts: *"I've noticed a few times that patients simply, um (..) agree, um, but don't understand and say yes out of politeness or because they're ashamed" (EXA01: 27), "Well, I mean, some students are just really shy (..) and then they're too inhibited to actually admit when they haven't understood something." (EXU04: 44)*

Segments coded as overlapping Non-Understanding and Situational Knowledge capture instances in which explainers connect explainees' lack of understanding to specific, situation-relevant knowledge in the explanation. For example, one primary school teacher stated: *"Well, um, you can't just tell children, 'Five plus five equals ten.' Some of them might know that, but they don't understand the reasoning behind it." (EXL06:24).* Similarly, a physician described recognizing gaps in explainees' applied understanding of nutrition when talking about metabolic conditions: "*When it comes to metabolic disorders, diabetes that may have just been diagnosed, or a lipid metabolism disorder, you notice during the conversation and also over time that the person didn't really understand what nutrition is about." (EXA03: 28).*

Notably, a university lecturer reported using explainees' questions as diagnostic cues to assess whether the perceived non-understanding reflects missing situational knowledge from the current explanation or broader gaps in prior knowledge: *"I often notice, um, from the type of question, what might be missing, right? So now it's not just, missing from what I just explained, but possibly also missing from other foundational knowledge." (EXU07: 59).*

4 Discussion

Despite the recognized importance of adaptive explanations in educational contexts, one essential prerequisite has received little attention so far: the specific partner-model dimensions considered by explainers. The present study takes a step toward addressing this gap by investigating how professionals who frequently engage in explanatory interactions conceptualize relevant dimensions of a partner model. To inform our approach, we reviewed research on partner models and their dimensions (e.g., Brennan et al., 2010) as well as predictors of learning (e.g., Costa et al., 2024; Frenzel et al, 2009)., which informed the deductive categories used in the subsequent content analysis. To gather expert knowledge, we conducted semi-structured interviews with professionals who regularly provide explanations as part of their work, namely school teachers, university lecturers, and physicians.

Regarding a first research question about dimensions of partner model dimensions of explainers, i.e., the characteristics

of explainees that they consider particularly important, the content analyses confirmed Understanding as the most frequently mentioned dimension of the partner model in explanations. Following Dillenbourg et al., 2016, it can be categorized as a situational dimension regarding a state of the explainee in the given explanatory interaction. Importantly, the analysis showed that interviewees did not refer only to achieved or assumed understanding, but also frequently to explicit instances of non-understanding, such as misunderstanding, confusion, or difficulties in following the explanation. Conceptually, these references can be seen as belonging to the same broader continuum of understanding. However, they were retained as a separate subcategory because they played a distinct functional role in the interviewees' accounts: perceived non-understanding often served as an anchor for adapting, repeating, elaborating, or redirecting the explanation.

This distinction therefore should not be interpreted as introducing an independent construct in addition to Understanding, but as differentiating empirically salient manifestations within the broader understanding-related dimension of the partner model. In this sense, the analysis avoids conceptual double-counting by treating Non-Understanding as a specific, explicitly coded form of reference to the explainee's understanding state rather than as an additional dimension. The differentiation was not previously reflected in the partner model literature. However, recent linguistic studies have already identified multimodal cues related to both understanding and non-understanding during explanations (Türk et al., 2024).

The category Engagement emerged as the second most frequently mentioned category. The interviewees described Engagement through verbal participation, questions, feedback and visible attention but also through its absence, such as passivity, distraction, or withdrawal. Given the overlaps and differing indicators across the three groups, we have kept it within this broad category. In a more nuanced questioning, engagement could likely be distinguished between attentiveness (Robrecht and Kopp, 2023) and active participation in the interaction in the sense of a co-construction of the explanation (Rohlfing et al., 2021; cf. Buhl et al., 2024).

Beyond the deductive dimensions anticipated from the literature, the content analysis identified Skills & Abilities as a further and actually frequently mentioned dimension of partner models. This category comprised relatively abstract attributions concerning language, cognitive, educational, and domain-related prerequisites. These attributions often served as dispositional indicators about what kinds of explanations were feasible or appropriate for a specific explainee.

As expected, the interviewees frequently addressed their counterparts' Emotions. However, this was particularly true of physicians, who must deal with patients' fears and concerns. Accordingly, they reported taking negative emotions into account above all. In the education sector, positive emotions also played a significant role in the explanatory process, e.g., satisfaction with understanding.

The literature on partner models in explanations draws primarily from the fields of tutoring and instructional explanations. Following the significance of these dimensions as learning prerequisites, it highlights (prior) knowledge and the interest of the learners as key partner model dimensions (e.g., Wittwer and Renkl, 2008). In our interviews, neither of these aspects was identified as a priority, but both were mentioned quite frequently. For both Knowledge and Interest a clear distinction between a dispositional and situational dimension emerged.

With regard to Knowledge, the interviewees differentiated between the explainees' Prior Knowledge and Situational Knowledge, i.e., the explainees' specific knowledge regarding the explanandum during the explanatory process. Prior Knowledge was underlined by the teachers and lecturers, Situational Knowledge more often by physicians. Interviewees from all groups explained that they must take prior knowledge into account and ensure, while explaining, that the specific knowledge develops as expected.

Also, Interest was mentioned as a situational and a dispositional partner model dimension. According to Krapp, 2007 in educational settings relatively stable traits are intertwined with situational interests which are triggered by the concrete context. Regarding explanations, the interviewees differentiated between interest in the explanandum which can be dispositional as well as situational and situational interest in the explanation.

A further category emerged inductively from the material, which was called Agency. Across all three professional groups, interviewees described explainees' characteristics related to active problem-solving, autonomy, and, conversely, passivity or resignation.

They can be summarized as the explainee's reliance and willingness to act as an independent interlocutor in the explanation. In the analyses, the category was associated with Agency as a trait variable known from research on social cognition (Abele et al., 2008). Agency is characterized as "a person's striving to be independent, to control one's environment" (Abele et al., 2008, p. 1204). Agentic individuals are autonomous and individualistic, aspiring to achieve their goals, even if they must overcome obstacles. This relates to intellectual desirability, competence, initiating structure, instrumentality, egoistic bias, dominance, and an independent self-construal (Abele and Wojciszke, 2007, p. 752).

However, the interviews with physicians in particular illustrate that agency cannot be inferred unambiguously from the degree of visible participation alone. In informed consent contexts, patients who avoid further explanation or delegate the decision to the physician may appear passive at first glance. Yet such behavior may also reflect an autonomous preference not to receive additional information, consistent with the "right not to know" (Laurie, 2014). Thus, non-participation is not necessarily equivalent to low agency. We therefore treated such cases as interpretively ambiguous unless the interview segment contained additional contextual indicators, such as resignation, low self-efficacy, uncertainty, or avoidance framed by the interviewee as problematic. Conversely, refusal of information was interpreted as an expression of agency when it was described as voluntary, informed, and aligned with the patient's own preference. This distinction is important because agency in explanatory situations may be expressed not only through active questioning and decision-making, but also through autonomous limitation of information.

To consider the effects of guided practice in teacher education on explainers (teachers and, to a lower degree, university lecturers) and the resulting stereotypical expectations about what should be mentioned as partner model dimensions, three groups of explainers were interviewed. Due to the small sample size and the absence of testable hypotheses, no inferential statistics were applied. Inspection of the data indicated minor differences between the partner models mentioned by the different professional groups. Understanding, Knowledge, Interest, and Skills & Abilities played a comparable role across all groups. However, given the nature of the explanation and their personal relevance, Emotions and Agency emerged as more prominent categories for physicians. In contrast, Engagement was mentioned more frequently in educational settings. These obvious differences highlight the influence of the explanatory context (Sanneman and Shah, 2022).

In a second step, we investigated how the central partner model dimensions Understanding and Non-Understanding were related to further dimensions in the explainers' statements. Therefore, it was visualized how often Understanding respectively Non-Understanding were assigned to a segment together with a further partner model category. The relational analysis showed that understanding was frequently related to Skills & Abilities, Engagement and Situational Knowledge. The underlying text fragments identified the first two as prerequisites of understanding. In contrast, Situational Knowledge was mentioned as a consequence of the process of understanding.

The most frequent intersections of Non-Understanding showed with Engagement, Skills & Abilities and Negative Mood. Explainees viewed (a lack of) engagement, on the one hand, as a reason for non-understanding, on the other hand as an indication of a lack of understanding. In contrast, a lack of Skills or Abilities is a cause of Non-Understanding, Negative Mood a consequence like frustration and fear. From an educational psychology viewpoint, theories of achievement emotions underline such associations with appraisals of missing control and high value of a learning outcome, i.e., the learners' understanding (cf. Pekrun, 2006).

In sum, this approach provides insight into which characteristics of explainees explainers consider to be particularly closely related in a direct verbal context with their understanding, including both prerequisites and outcomes of Understanding and Non-Understanding.

4.1 Limitations and future directions

The present findings provide valuable insights into the dimensions of partner models as described by the explainers. However, several limitations point to the need for further research. With the focus on the empirical study and its emphasis on explanations, the literature primarily served as a background to derive initial deductive categories as a starting point. In line with our interest, we concentrated on the "partner model". The inductive categories pointed to the benefits of a broader conceptual background taking into account related concepts from social cognition (Abele et al., 2008). Even a broader range of concepts could yield additional insights and help to expand the conceptual foundation, e.g., mentalizing, mind reading, or group awareness (Buder et al., 2021; c.f. Buhl et al., 2026; Turner and Felisberti, 2017; Westra and Nagel, 2021).

Further limitations relate to the empirical implementation. Due to the complexity of the qualitative approach involving interviews and content analysis, we concentrated on three groups of explainers, for each the sample size is inherently small. However, the coding indicated that category development had reached saturation: After the eighth interview, no additional candidate main categories or subcategories emerged from the thematically clustered coded segments. Subsequent interviews only provided additional text segments, examples, and contextual nuances that could be assigned to the existing categories.

The influence of the chosen explainer groups is probably more significant. In order to capture a broad range of perspectives, primary school teachers, university lecturers, and physicians were interviewed. The interviews with physicians focused on medical consultations, such as preoperative consultations or those aimed at obtaining informed consent. This specific setting was accompanied by a greater emphasis on emotions as dimensions of the partner model than in the educational context. Moreover, the interview guide and the way the interviews were conducted may have influenced the findings. Regarding the significance of learners' or patients' emotions, the interview questions primarily addressed negative emotions. This may explain why the results highlighted negative more than positive emotions as dimensions of the partner model.

A further limitation concerns the disciplinary heterogeneity within the professional groups. Although participants were grouped according to their professional role as primary school teachers, university lecturers, or physicians, each group comprised explainers from different subject areas or medical specializations. For instance, primary school teachers taught subjects such as mathematics, German, physical education, art, religious education, and general science; university lecturers represented fields such as physics, psychology, electrical engineering, and German philology; and physicians came from different medical specialties. These disciplinary differences may shape the kinds of explanations typically provided, the interactional setting, and possibly even the relevance of particular partner-model dimensions. Consequently, some of the observed variation within and between groups may reflect disciplinary or domain-specific explanation practices rather than professional-group membership alone. Because of the small and exploratory qualitative sample, these potential domain effects could not be controlled for or analyzed systematically.

Following the content analysis, the relational analysis also yielded important insights. The alignment with psychological theories validates the findings to date. However, it should be emphasized that here, categories were only identified as co-occurring with (*Non*-)Understanding if they were coded within the same segment. Further contextual connections would become apparent in further analyses.

4.2 Implications

The knowledge gained about partner model dimensions can be used to support teacher professional development. Teachers and university lecturers can be better prepared to adapt their explanations to individual learners. At the same time, their expectations and stereotypes regarding students can be critically

reflected upon as part of the partner model and systematically addressed. Dimensions of partner models in general—and our findings in particular—can also inform the design of digital learning tools, such as intelligent tutoring systems or social explainable artificial intelligence (Rohlfing et al., 2026). The importance of integrating partner models into such systems is increasingly acknowledged (Booshehri et al., 2024; Robrecht and Kopp, 2023; Schmid and Brede, 2022). In the future, the selection of relevant dimensions could be increasingly grounded in empirical research.

Additionally, considering partner model dimensions represents an important area of application for understanding the role of social cognitions in educational settings. It is frequently discussed that, in the course of an explanation, interaction with a learner can lead to changes in the explainer's partner model (Brennan et al., 2010; Dillenbourg, et al., 2016). Knowledge of relevant dimensions of the partner model enables researchers to examine the relationship between cognition and behavior, and thus the adaptivity of explanatory processes (Buhl et al., 2024).

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Ethik-Kommission der Universität Paderborn. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

VG: Formal analysis, Visualization, Writing – original draft. HB: Conceptualization, Funding acquisition, Writing – original draft, Writing – review & editing.

Funding

The author(s) declared that financial support was received for this work and/or its publication. This work was funded by the Deutsche Forschungsgemeinschaft (DFG): TRR 318/1 2021–438445824 and TRR 318/3 2026–438445824.

Acknowledgments

We thank the interviewees who supported this research and Marco Verwiebe for his support as research assistant for supporting in data collection, transcription, content analysis, and translation of the interview guide as well as proofreading the translations of the interview excerpts.

Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declared that generative AI was used in the creation of this manuscript. The authors used OpenAI's ChatGPT (GPT−5.5; OpenAI, San Francisco, CA, USA) and DeepL Translator/Write (DeepL SE, Cologne, Germany) for language editing, and stylistic revision. All content was reviewed and approved by the authors. Generative AI was not involved in translating the interview excerpts or interpreting the data.

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