# Teacher framing, classroom collaboration scripts, and help-seeking and help-giving behaviors

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**Abstract:** This case study investigated students' collaborative help-seeking and their teachers' help-giving behaviors in inquiry-based learning. Data from two pairs of middle-school students, using two different scaffolding scripts, and from their biology teacher, were collected and analyzed. The following research questions were pursued: How does each collaboration script influence students' help-seeking and teachers' help-giving activity? Data included videotapes of each pair's interactions, the discussions between the pairs and the teacher, whole-class discussions, learning assessments and a teacher interview. Findings indicated that the pair in the *ImplicitScaffolding* script sought help less frequently than the *ExplicitScaffolding* pair while the nature of the help sought was different. Findings also showed that the different scaffolding scripts impacted student motivation and framed the teacher expectations differently, regardless of the type of help sought by the students. These findings highlight the connection between collaboration scripts, teacher cognition and scaffolding, and bear implications about students and teachers.

## Introduction

While inquiry is widely accepted as a means to facilitate learning in science, inquiry-based tasks can still be highly challenging for students, especially when students are not appropriately and sufficiently supported (Kollar, Fischer, & Slotta, 2007; Linn, 2006). Research has provided evidence that help-seeking is often related to better learning (Nelson-Le Gall, 1981) while at the same time there is evidence that students do not often engage in such activities (Aleven, Stahl, Schworm, Fischer, & Wallace, 2003). Effective help seeking strategies could promote student learning in such inquiry-based learning environments (e.g. Aleven et al., 2003). Considering that help seeking is an important meta-cognitive skill (Nelson-LeGall, 1981; Newman, 1994) several researchers have focused on designing learning environments promoting help-seeking behaviors (Aleven & Koedinger, 2001), tried to explicitly teach this skill to students (e.g. Ames, 1983; Nelson-LeGall, 1981; Newman, 1994) and tried to motivate students to seek help more often. While students' help-seeking behavior has received some attention in the literature, it appears that teachers' help-giving behaviors have been largely ignored in such discussions (Butler, 2006).

The present study is a multiple case-study into students' collaborative help-seeking behavior. It examines students' collaborative help-seeking and teacher's help-giving in two comparable contexts, each using a different classroom script to support student collaboration. The first context involved a guided inquiry environment, in which students collaborated to address a biological problem. This environment (*ExplicitScaffolding*) relied on the teacher, peer collaboration, and worksheets to support the learning process. The second context involved a less-structured inquiry environment, in which students collaborated to address the same biological problem on the computer. This environment (*ImplicitScaffolding*) relied on the web-based inquiry investigation, peer collaboration and the teacher for guidance. We investigate the following research questions: How does each classroom script influence the framing of the teaching and learning activity? Specifically, a) how does the group help-seeking behavior differ in explicit vs. implicit scripted learning environments and b) how does the teacher help-giving behavior differ in such context?

## Theoretical Framework

Our work draws on literature conducted on small group collaboration scripts, students' self-regulated learning as it relates to help seeking, scaffolding and teacher cognition. In this study, we specifically seek to explore whether the collaboration script in inquiry-based learning, a topic discussed in Makitalo-Siegl, Kohnle and Fischer (2011) influenced the help-seeking behavior of the students and the help-giving behavior of the teacher. Collaboration scripts seek to structure collaborative activity in meaningful ways and support intersubjective learning (Kobbe et al., 2007; Kollar, Fischer, & Friedrich, 2006; Kollar, Fischer, & Slotta, 2007). Kobbe et al. (2007) identified five important components of collaboration scripts: learning objectives, type of activities, sequencing, role distribution, and representation type. Whereas the Makitalo-Siegl et al. (2011) study explored

two different versions of collaboration scripts both provided by the Web-based Inquiry Science Environment (WISE) learning platform we wanted to explore students' help-seeking behavior in more traditional (learning environment+worksheets) setting versus in more open-ended, yet scaffolded versions (web-based learning environment + web-based scaffolded articulation spaces).

Makitalo-Siegl, Kohnle and Fischer (2011) investigated whether students, working in collaborative inquiry settings employing high and low-structured classroom scripts, appropriately used available help. Confirming prior studies, Makitalo-Siegl et al. found that students did not engage in much help-seeking in either context. Furthermore, exploring the effect of low-structure and high-structure collaboration scripts provided through the WISE platform, Makitalo-Siegl et al. found that students in the low-structure situation engaged in statistically significant more help seeking than students in the high-structure situation, and that students in the low-structure situation exhibited smaller learning gains than the students in the high-structure condition.

While teacher scaffolding (e.g. Tabak, 2004) and the use of technology to scaffold student learning (e.g. Quintana et al., 2004; Lu, Lajoie, & Wiseman, 2010) are topics that have received significant attention to date, teachers' help-giving behavior, in response to student help-seeking is a topic that has not been discussed much. We believe that coupling the investigation of the two phenomena of interest (students not seeking help much even though help-seeking is positively associated with learning and teacher cognition in providing help to support collaborative inquiry learning) merits further examination.

## Methodology

### Participants

#### Teacher

One biology teacher, with five years of teaching experience and a master's in science education, and her 7$^{th}$ grade students at an urban middle-school were involved in this study. The teacher (Mrs. Tonia, a pseudonym) was a member of a participatory design group who collaborated to design the learning materials with the goal of supporting inquiry learning; she did not participate in the planning of this research study nor was she aware of the specific research questions. Mrs. Tonia enacted the learning module using the *ExplicitScaffolding* collaboration materials with one of her classes and used the web-based, *ImplicitScaffolding* materials with her second class. The teacher was familiar with both approaches to inquiry-based learning.

#### Students

Two intact classes, taught by the same teacher (Mrs. Tonia) participated in this study. Conceptual understanding assessments and motivation surveys were administered to all students following a pre-post design. The analysis of the conceptual understanding pre-test indicated no statistically significant difference in terms of the two classes' content knowledge before the teaching intervention ($Z=-.052$, $p=.958$), indicating that students in each collaboration script were equivalent in terms of their prior knowledge regarding the human reproductive system. Similarly, the comparison of students' motivation in the two collaboration scripts did not indicate any statistically significant differences in terms of students' views about a traditional biology lesson ($Z=-1.191$, $p=.234$) or about an ideal biology lesson ($Z=-1.772$, $p=.076$). Hence, these results, confirmed that both classrooms were equivalent in terms of students' motivation.

Two pairs of students (one from each of the classes taught by the same teacher) formed our case study groups in this study. Students in each pair were 12-year-old girls of comparable academic performance and motivation to engage in science learning, as assessed by their teacher and as confirmed by their grades in language arts and science education. The pairs were selected by the teacher due to their comparability and to their willingness to be videotaped. Data from two other pairs were also collected but were not analyzed for this paper.

### Implementation context

#### Intervention

The teaching intervention consisted of seven, 80-minute sessions. Students, assuming the role of a doctor, investigated a scenario-driven problem that dealt with human reproduction; according to this scenario students were involved with a socio-scientific investigation, gathering, interpreting and synthesizing secondary information in order to take an evidence-based decision and to offer advice to a young couple seeking medical advice in order to have a baby.

### Collaboration Scripts

Two collaboration scripts, one in each classroom, were employed. In the *ExplicitScaffolding* script each pair worked with learning materials and worksheets and relied on the teacher, on peer collaboration and on the worksheets to progress with solving the problem posed to them. In the *ImplicitScaffolding* script each pair had access to the same learning materials organized using a web-based educational application and used online articulation spaces with general type prompts to organize their inquiry. Students relied on prompts provided online, on peer collaboration and on the teacher for guidance. In both conditions, the teacher was available during the sessions and walked around the classroom in a non-systematic manner while students were working in pairs. At the end of the unit, a plenary discussion was led by the teacher in both conditions. One researcher was present during the lessons to collect enactment data from each classroom script.

## Data Coding and Analysis

All classroom interactions were videotaped, including discourse at the level of the pair and whole class discussions with the teacher. The data were transcribed verbatim and were coded using qualitative analysis software. A forty-minute interview with the teacher after the implementation investigated how she considered her role in each learning environment in terms of scaffolding the students. Conceptual understanding achievement tests and motivation surveys were also administered prior to and after the learning intervention to students in both classrooms.

We coded all instances of each pair's help-seeking and teacher's help-giving behavior using a coding scheme informed by prior studies (Makitalo-Siegl, Kohnle & Fischer, 2011). The coding was performed at episode level and focused on six areas: context of help-seeking, type of help sought, content of help sought, type of help provided, recipient of help, and usage of help. All coding categories and their definitions are shown in Table 1. An inter-rater reliability check performed by two of the authors yielded a score of 90% agreement. All disagreements were first discussed and resolved between the two coders; subsequently, all data were coded accordingly by one of the coders.

Table 1: Help-seeking and help-giving coding scheme

| **Coding category** | **Definition** |
|---|---|
| 1. Context of help-seeking | This category describes the context in which students seek for helping |
| 1.1Student-centered | The students ask for help while collaborating for their investigation |
| 1.2 Teacher-centered | The students ask for help while participating into a whole-class discussion led by the teacher |
| 2. Type of help sought | This category characterizes the type of help sought by the students |
| 2.1. Executive | Students request direct answers such as "is this right" |
| 2.2. Instrumental | Students request help to support them figuring out the problem on their own |
| 3. Content of help sought | This category characterizes the content of help sought by the students |
| 3.1 Domain knowledge | Students ask for help regarding a domain related issue (e.g. reproductive system) |
| 3.2 Inquiry skills | Students ask for help regarding an inquiry skill (e.g. how to formulate hypotheses) |
| 3.3 Procedural issues | Students seek help regarding procedural or writing issues (e.g. asking for the repeat of a statement so that they can copy it correctly, discussing grammar, etc.) |
| 4. Type of help provided | This category characterizes the type of help given to the students |
| 4.1 Executive | Direct answers are provided as help |
| 4.2 Instrumental | Students are scaffolded in finding the answer on their own |
| 4.3 None | No help is provided to the students |
| 5. Recipient of help | This category describes how help giving is provided |
| 5.1 Help provided to the group | Help is provided to the students who sought it |
| 5.2 Help provided to the whole class | Help is provided to the whole class, in response to the students' help seeking |

| | |
|---|---|
| 6. Usage of help | This category codes whether students have followed up on the advice provided by the teacher or other peers. |
| 6.1 Help used | The students utilize the help given |
| 6.1 Help not used | The students do not utilize the help given |
| 6.2 Insufficient data | The available data do not allow determining whether the help provided was utilized by the students |

After the initial identification and coding of episodes (n=42), episodes were analyzed for emerging patterns, examining the data first at the episode level and then contrasting episodes with each other. Episodes presenting similar patterns were then grouped to determine dominant trends in each of the two scripted environments. This analysis represents the crux of what we are interested in, as we seek to explore the relationship between scripts, students' collaborative behavior and the teacher's response.

## Findings

The analysis of the data informs our case study approach (Yin, 2003), with the multiple sources of data and the different data analyses serving to triangulate our findings. In this section we first present findings on the pairs' help-seeking behavior and then present the results of the pattern analysis which examines students' help-seeking behavior as coupled with the teacher's help-giving behavior.

### Help-seeking

Of the 42 episodes identified, 27 belonged to the explicit and 15 to the implicit scaffolding script. Whereas all help-seeking in the implicit scaffolding script (*ImplicitScaffolding*) took place in the context of the collaboration of the pair, 12 of the 27 episodes (44%) of the explicit scaffolding script (*ExplicitScaffolding*) occurred in the context of whole-class discussions with the teacher. The *ExplicitScaffolding* pair sought executive help more often, seeking directly the "right answer" whereas the *ImplicitScaffolding* pair sought more instrumental and procedural help. Table 2 presents these findings.

Table 2: Help-seeking and help-giving findings

| | **No of episodes and percentages** | |
|---|---|---|
| | *ImplicitScaffolding* Script (N=15) | *ExplicitScaffolding* Script (N=27) |
| **Context of help seeking** | | |
| *Student-centered* | 15 (100%) | 15 (56%) |
| *Teacher-centered* | 0 (0%) | 12 (44%) |
| **Type of help sought** | | |
| *Executive* | 5 (33%) | 18 (67%) |
| *Instrumental* | 10 (67%) | 9 (33%) |
| **Content of help sought** | | |
| *Domain knowledge* | 5 (34%) | 21 (78%) |
| *Inquiry skills* | 0 (0%) | 2 (7%) |
| *Procedural issues* | 8 (53%) | 4 (15%) |
| **Type of help provided** | | |
| *Executive* | 11 (73%) | 17 (63%) |
| *Instrumental* | 3 (20%) | 3 (11%) |
| *None* | 1 (7%) | 7 (26%) |
| **Recipient of help** | | |
| *Help provided to the group* | 14 (100%) | 12 (60%) |
| *Help provided to whole class* | 0 (0%) | 8 (40%) |
| **Usage of help** | | |
| *Help used* | 14 (100%) | 12 (60%) |
| *Insufficient data* | 0 (0%) | 8 (40%) |

### Help-giving

In both collaboration scripts, the teacher provided students mainly with executive (more direct answers and explicit guidance) rather than instrumental help (73% of the episodes for the *ImplicitScaffolding* pair and 63% of the time for the *ExplicitScaffolding* pair). In 7 out of 27 episodes (26%) the pair was not provided with help

in the explicit guidance script, whereas also in 8 of the 20 episodes when help was given it was provided in the context of a whole-class discussion and was not related to the specifics of the collaborative work conducted by the pair.

## Analysis of help-giving and help-seeking patterns

Each pair's help-giving and help-seeking episodes were analyzed separately to identify collaboration patterns. The dominant patterns (showing up in at least 5 episodes each) are shown in Figure 1.

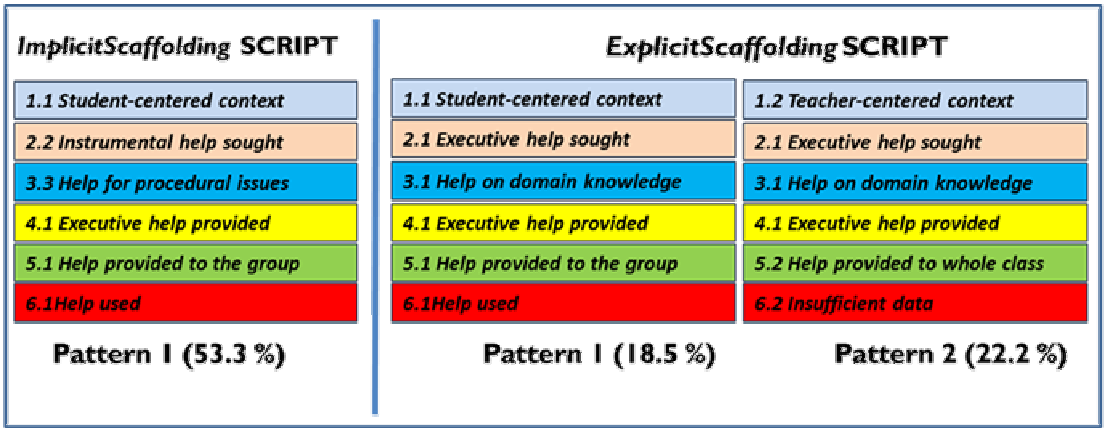


Figure 1. Help-giving and help-seeking dominant patterns identified

Six different patterns were identified in the *ImplicitScaffolding* script, with one of them being a dominant pattern since it was identified in eight of the episodes. According to this pattern the two girls at several points sought instrumental help since they were asking for supportive guidance to continue with their process of inquiry. The teacher responded to the pair's help-seeking by providing executive help, helping define next steps; this help was taken up by the pair. The following brief excerpt illustrates this pattern:

*[Episode 9, ImplicitScaffolding script]*
*Maria:* *Mrs…*
*Teacher:* *Yes?*
*Maria:* *There's an instruction here asking us to complete the template "From fertilization to birth" but there is also another template…*
*Teacher:* *Have you completed the "Menstrual Cycle" [template]?*
*Maria:* *Yes.*
*Teacher:* *Ok… Then this is the right template.*
*Maria:* *Just a moment.*
*Teacher:* *This is the right template.*
*Anna:* *Let's read [the sources] first.*
*Maria:* *No.*
*Teacher:* *Name your template first.*
*Maria:* *What should we name it?*
*Anna:* *"Birth" because it refers on the natural way of childbearing…*
*Maria:* *Fetus…*
*Teacher:* *So now you should answer all of these questions [on the template] regarding the natural way of childbearing.*
*The pair continues with their work.*

On the other hand, the pattern analysis in the 27 help-seeking/help-giving episodes of the *ExplicitScaffolding* script revealed fourteen different patterns, two of which were identified as dominant, being detected in five and six different episodes respectively. For example, according to the first dominant pattern the pair sought executive help on several occasions since they were asking directly for the "right" answer regarding domain knowledge necessary to finish their task. The teacher provided the pair with executive help, giving "right answers"; this help was taken up by the pair, who mechanically wrote the right answers. The following brief excerpt illustrates this pattern:

*[Episode 8, ExplicitScaffolding script]*

> *Fiona: Mrs Tonia, should we write that [the ovaries] stop releasing ovules after a certain age?*
> *Teacher: Yes… Because this is the way they function…*

*The girls record the right answer on their worksheet.*

As the teacher explained in her post-enactment interview her instructional objectives remained the same in both situations: *"The aims were the same… What had changed was the approach in order to see how the development of inquiry skills, content knowledge and collaboration could be promoted. It shouldn't be right to have different aims… I had the same aims but within a different approach in order to see the result…"*

However, the teacher felt that in spite of identical educational objectives her role should be differentiated. Mrs. Tonia felt that in the *ImplicitScaffolding* script there was no need to guide her students except with some procedural issues that concerned the details of using the templates provided. In contrast, in the *ExplicitScaffolding* script she felt that she should comment on students' work more frequently, correcting their answers to their worksheets and providing more explicit guidance through whole class discussions.

> *[In the ImplicitScaffolding script] I was talking as less as I could compared to the other class. The only thing that [my students] needed was that they wanted to know what exactly they should do in some of the templates … I didn't want to guide them. I wanted each pair to move at their own pace…*

> *[In the ExplicitScaffolding script] things were more guided. The whole class should stop at the same point in order to make some comments, to move forward and to check the answers to the questions they worked on by the end of the lesson. And after all, the lesson was guided by me… I mean that they followed their worksheets but we should stop at the same point, as indicated in lesson plan, in order to watch a video or to talk about how to go on… It was something very different…*

> *The [ImplicitScaffolding] provided by the web-based tool could function more autonomously. Students could work without my own help… In contrast, in the other class, if I were not to give instructions, the students could not work so easily I guess…*

### Conceptual understanding achievement tests

The statistical analysis of the students' pre- and the post-test on conceptual understanding, employing the Wilcoxon sign rank test, yielded statistically significant results for the students in the *ImplicitScaffolding* script (Z=-2.785, p=.000) as well as for the students in the *ExplicitScaffolding* script (Z=-4.012, p=.000). Therefore, it can be concluded that students in both classroom scripts presented a statistically significant difference in their learning gains, as an outcome of the learning intervention.

### Motivational assessment test

The comparison of students' responses to a survey about the motivational potential of a traditional biology lesson and the motivational potential of an ideal lesson, indicated that a traditional biology lesson was much less motivating than an ideal biology lesson; the difference was statistically significant for both the students in the *ImplicitScaffolding* script (Z=-2.925, p=.003) as well as for the students in the *ExplicitScaffolding* script (Z=-3.142, p=.002). Even though there was no statistically significant difference for the students of the *ExplicitScaffolding* script (Z=-.735, p=.462) between the inquiry lessons they attended and their traditional biology lessons, the analysis of the responses of the students in the *ImplicitScaffolding* script indicated a statistically significant difference between the inquiry lessons and their traditional biology lessons (Z=-2.591, p=.010), in favor of the inquiry lessons.

## Discussion and Implications

Help seeking processes can be affected by patterns of classroom interaction and facilitated by instruction (Aleven et al., 2003; Karabenick & Newman, 2009; Oortwijn, Boekaerts, Vedder, & Strijbos, 2008). However, there has been little research on the question concerning how different patterns of classroom interaction may differentiate the process of help-seeking and help-giving to date. Aiming to shed some light to this underexplored area, the present study focused on help-seeking / help-giving behaviors using two different classroom scripts to teach an inquiry-based biology learning module.

According to our findings, the *ImplicitScaffolding* scripts provided our case study students with the necessary structure and guidance and supported their learning. In contrast, the *ExplicitScaffolding* classroom

script constrained the pair's autonomous inquiry, as the students' help-seeking and help-giving behavior showed. The differentiation observed in the process of students' help seeking could be partially attributed to each classroom script, which afforded different teacher and students' interactions that differentially shaped the process of help-seeking and help-giving. The dominant patterns of student help-seeking and teacher help-giving behaviors were different in each scaffolding script. In the case of the *ImplicitScaffolding* script, the pair working with the web-based learning environment framed their inquiry as a multi-step process. In this context, students asked mainly for instrumental help when they felt uncertain about how to carry forward with their investigation. In contrast, in the *ExplicitScaffolding* script, students sought help more frequently, sought more executive help and requested direct answers relating to domain knowledge. While students in the *ImplicitScaffolding* script sought less help when compared to the help-seeking behavior of the students in the *ExplicitScaffolding* script, no statistically significant differences were found between the classes and both classes improved on the conceptual understanding test. This suggests that, perhaps, students in the *ImplicitScaffolding* script voiced fewer questions because the scaffolds may have afforded a process that helped them answer questions in the context of collaboration and thus reducing the need for teacher guidance. Such results are supported by discussions about the reflective affordances of articulation tools and processes (e.g. Chi, de Leeuw, Chiu, & Lavancher, 1994; Quintana et al., 2004).

The results of all students' motivation surveys, comparing the students' views between the current (inquiry) and past (traditional) biology lessons indicated a statistically significant difference between the two collaboration scripts. The results suggest that students found the *ImplicitScaffolding* script more motivating than past instructional settings; this is important as motivation has been reported as having the capacity to result to enhanced learning (Blumenfeld, Kempler & Krajcik, 2006). As Makitalo-Siegl et al. (2011) discussed, different classroom scripts impact help-seeking behavior; Makitalo-Siegl et al. found that students who participated in collaborative learning environments providing appropriate structure and scaffolding, tended to seek help much less and to achieve better learning results. In our case, data support the first but not the second conclusion. However, it maybe that the learning assessments only capture part of the learning occurring in such contexts; indeed, if self-regulated inquiry learning is what we are pursuing the use of other assessments tapping into inquiry-related and metacognitive skills should be explored.

The teacher also responded differently in each of the classroom scripts, as suggested by the analysis of the video and teacher interview data. The teacher's behavior was framed by the context, as the teacher assumed that students in the *ImplicitScaffolding* script should be able to work more autonomously, while she felt that the students in the *ExplicitScaffolding* script needed more guidance and structure. Hence, it is no surprise that in this context, students' help-seeking/help-giving episodes in the *ExplicitScaffolding* script often took place into a more teacher-centered environment, while the opposite was true for the *ImplicitScaffolding* script. Levin, Hammer and Coffey (2009) discussed the concept of teacher framing as a way to understand teacher attention. According to Levin and his colleagues "whether and how teachers attend and respond to student thinking largely reflects how they frame what is taking place in their classes" (p.143). While Levin et al. suggested that institutional requirements frame teacher activity to selectively attend to issues of learning and teaching, curricular materials, especially new methods of teaching may also have a similar impact. This topic merits further exploration as it relates to teacher professional development through curricula that have educative properties, even when these properties are not explicitly communicated to teachers (Davis & Krajcik, 2005).

A, rather, unexpected finding is that the teacher provided executive help to most of the pairs' requests, regardless of the collaboration script. This may be explained by the finding that students in one situation (*ExplicitScaffolding*) requested such type of response whereas most of the questions students posed in the other situation (*ImplicitScaffolding*) were instrumental for their process but yet could be often answered via executive support. Future qualitative exploration of our dataset, as well as the analysis of the videotaped interactions of two additional pairs not included in this analysis (one in each scaffolding condition) can help elucidate our findings and provide better insights into the conditions under which each type of support provided may be most helpful.

These findings contribute to our understanding of students' help-seeking behavior and how to better support it, and can inform teacher professional development. In terms of student help-seeking, and as suggested by the conceptual understanding achievement tests administered in this study, it seems that environments providing *ImplicitScaffolding* may be providing the support that students need to achieve positive learning results, while in environments where this type of support is missing students necessarily turn to teachers to find that additional support necessary to complete the task. Where the participating teacher was concerned, our findings suggested that the framing of the task may have heavily influenced the teacher's perceptions of what she was expected to do and how she should guide student inquiry; both tools and teachers' reflection-on-action (Schon, 1983) are necessary to help teachers move towards improved support of students' self-regulated behavior. These findings highlight the connections between collaboration scripts, teacher cognition and scaffolding and bear implications about students and teachers. Future studies should examine the topic

employing different methodologies and large sample sizes, connecting analyses to specific tasks, and investigating the issues in other contexts.

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