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Emergent Roles and Collaborative Discourse Over Time

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Abstract: CSCL environments are intended to foster equal participation even when student roles are not assigned. However, roles may spontaneously emerge and result in distributed participation during collaboration, especially when students share and manage a single technology resource. We investigated how group discourse shaped emergent roles in a collaborative small group over the course of a 12-week science curriculum with simulated science experiments. Group members showed patterns in their discourse contributions in terms of content, function, and initiation and uptake of discourse topics. The emergence of these patterns stimulated role differentiation and stabilization. Conceptual discussion appeared to improve learning gains, while prioritization of task management detracted from learning. By tracking group discourse patterns, we can observe the process of role emergence in face-to-face CSCL interactions.

Keywords: roles, emergent, spontaneous, collaboration, discourse, learning outcomes

Introduction

CSCL environments are often designed to foster equal participation among group members without explicitly assigning specific roles. However, roles often emerge during collaborative learning (Strijbos & De Laat, 2010; Strijbos, De Laat, Martens & Jochems, 2005), influencing interactions and learning outcomes. When students present their developing understandings to the group, they open themselves to questions, critique, and requests for clarification or justification. This peer-review process, along with a focus on personal or collaborative goals, may impact how roles emerge from interactions (Strijbos & De Laat, 2010).

Roles, when self-assigned, are the personal undertaking of certain functions or responsibilities within the group that are designed to facilitate group progress towards a goal (Hare, 1994). Emerging roles develop spontaneously in response to a collaborative activity, as compared to scripted roles that are prescribed to facilitate collaboration and maximize learning gains (Strijbos & Weinberger, 2010). Roles emerge from social interactions that occur over time (Hoadley, 2010; Jahnke, 2010). Role formation or differentiation occurs when students impose responsibilities or functions on themselves or on other group members by positioning themselves, positioning others, or responding to others' positioning moves (Sarmiento & Shumar, 2010). Students who are comfortable divulging their developing knowledge may emerge as conceptual leaders or guides. Other students may take on group management or activity coordination tasks. Some students may deviate from expectedly "productive" roles and engage in off-task discussion. Ultimately the pattern of roles that emerges determines the efficiency of learning (Spada, 2010) and depth of knowledge co-construction for the group, with certain patterns of roles resulting in more effective learning (De Wever, Van Keer, Schellens & Valcke, 2010; Gu, Shao, Guo & Lim, 2015).

CSCL environments impact role formation because of the additional requirement of managing integrated technology during group discussion. By necessity, role establishment is more structured when a group shares a single technology resource during a face-to-face learning activity (Jones & Issroff, 2005). As only one student can manipulate the machine at a time, the student adopting this role becomes responsible for typing or entering inputs of information. He or she may seek group consensus on these inputs before entering them. In-group consensus becomes an issue of concern when session time is limited and task completion is favored over conceptual sharing or exploration (Bruhn, 2000).

In this study, we investigated how different types of discourse impacted emergent role formation within a collaborative small group. We also examined how different roles were associated with unbalanced learning gains for group members. Our research questions were: How do emerging roles shape discourse when students collaborate in a group? How does role differentiation impact learning gains for group members?

Methods

This study was part of the CoMPASS project (Puntambekar, Stylianou & Goldstein, 2007) designed to examine developing science literacy as students interacted with digital text and other scaffolded tools. The project included a 12-week design-based physics curriculum centered on concepts involving forces, work, energy and motion as applied to roller coaster design. In the classroom, students utilized the digital text, CoMPASS, and a roller coaster simulation while collaborating in the same small groups of three to five throughout the unit. Students recorded notes in their scientists' journals, which prompted students to individually and collaboratively generate questions and hypotheses, experiment within the simulation, record observations and data, and make conclusions about physics concepts and relationships. Data relevant to this study included video and audio recordings of 14 simulation experiments and pre- and post-measures of physics conceptual understanding.

Participants

This study focused on a subset of students from the larger study sample. We selected one balanced-gender group of four sixth-grade students (N=4) based on relatively high variability in post-assessment scores and availability of video data for analysis. These students are identified as Michael, Scott, Sandra and Amy for this study. They participated in a classroom of 22 students composing six groups total. They attended a large suburban public middle school in the US Midwest (U.S. Department of Education, 2013). In the 2011-2012 school year, 85.1% of the students were white and non-Hispanic, and 18.7% were eligible for free or reduced-price lunch (U.S. Department of Education, 2013).

Procedure and measures

We analyzed data for general observations of trends in discourse. The first author noted that students in this subset of the sample tended to perform the same discourse moves throughout the curriculum. The same group also had highly variable learning gains as measured by a conceptual understanding assessment (see next paragraph). To further investigate this pattern, video and audio data recordings of 14 simulation experiments were prepared for analysis.

We used a CoMPASS-designed physics test ("Physics Fiesta") to measure conceptual change shown as pre-post differences in assessment scores. This test consisted of 29 questions pertaining to concepts and relationships involving forces, work, energy, friction, and Newton's Laws. Correct items earned one point while incorrect items were given zero points. A score of 29 points was the highest possible score.

Analysis

Qualitative analysis

We imported video and audio data into Transana data analysis software for synchronization and transcription. We transcribed a total of 2,759 turns of talk over 14 sessions**.** We compiled these transcripts in Microsoft Excel and evaluated for general patterns prior to in-depth analysis. We designed a coding scheme using group discourse as the unit of analysis to identify discourse moves associated with emerging roles (see Table A1 in Appendix). The two-dimensional coding scheme identified initiation or uptake of topics (Discourse Action) and content (Discourse Type) in turns of talk (Strijbos & Stahl, 2007; Hmelo-Silver & Barrows, 2008; Van Aalst, 2009). An external coder familiar with the project helped establish inter-rater reliability; inter-rater percentage agreement was 85.64% after an initial round of 10% of total codes (281 turns of 2,759 total) and 99.82% after resolving differences through discussion. The first author coded the remaining turns, using multiple codes when appropriate. The coding scheme was not applicable to 13.16% of turns. We collapsed codes into three categories: Conceptual, Procedural and Negotiation, and Social (see Table A1). We created discourse profiles for each student. We created CORDTRA diagrams to visualize discourse contributions over time (Hmelo-Silver, Liu & Jordan, 2009).

Quantitative Analysis

We calculated the frequencies and proportions of total and collapsed discourse codes. Proportions allowed us to evaluate patterns in discourse contributions for less dominant speakers whose contributions were obscured by more dominant speakers. Proportions of each discourse group by code were categorized into student profiles for comparisons. Dependent-sample *t*-tests were utilized in analyzing differences in discourse contribution frequencies between students and simulations (de Winter, 2013). Percentage learning gains were calculated for the Physics Fiesta assessment.

Findings

Emerging roles over time

We investigated role emergence by comparing proportions of discourse contributions for each group member over the entirety of the 12-week curriculum; a temporal examination of contributions to specific discourse types provided insights into role differentiation and stabilization. Table 1 shows the proportions of discourse types for each student; proportions were calculated as contributions to each type of coded discourse. Figure 1 shows the discourse contribution profiles for each student as total contributions, which were then subdivided into initiation (Initiating) and uptake (Following) of discourse topics.

Each student showed a unique pattern in contributions to discourse types. Michael was the greatest overall contributor to total discourse (1049 turns), followed by Amy, Sandra and Scott (729, 567, and 405 turns, respectively). When comparing individual student profiles for total discourse contributions, we see that Michael contributed the most to conceptual discourse (.224), Sandra to procedural discourse (.762), and Scott to social discourse (.221). Amy showed a mixed-discourse profile indicating more balanced participation. Observations of initiation and uptake of discourse topics reflected similar contribution patterns. Michael tended to initiate conceptual and social talk (.291 and .171, respectively), while Amy and Sandra initiated procedural talk (.754 and .800, respectively). Scott followed up on social talk (.281), while Sandra continued discussions related to simulation procedures (.740). Amy and Michael followed discourse topics of all types.

Table 1: Proportions of discourse contributions

	Discourse Type	**Scott**	**Amy**	**Michael**	**Sandra**
Total	Conceptual	0.193	0.183	0.224	0.121
	Procedural	0.587	0.682	0.597	0.762
	Social	0.221	0.134	0.180	0.117
Initiating	Conceptual	0.214	0.172	0.291	0.106
	Procedural	0.630	0.754	0.538	0.800
	Social	0.156	0.073	0.171	0.094
Following	Conceptual	0.173	0.190	0.185	0.130
	Procedural	0.546	0.641	0.630	0.740
	Social	0.281	0.170	0.185	0.130

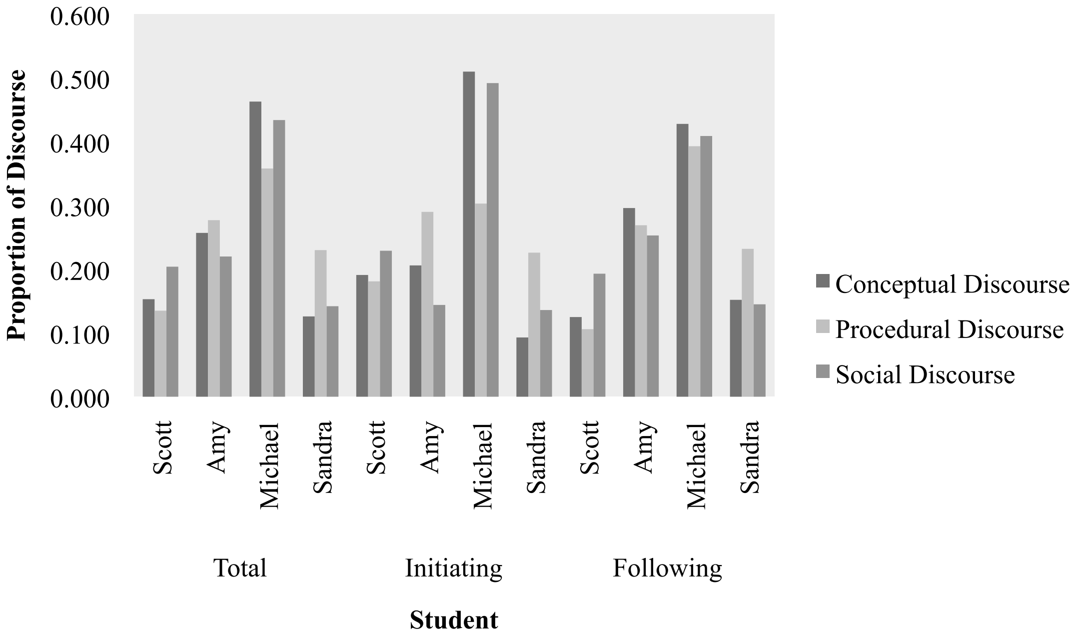

Figure 1. Student profiles of discourse contributions

We evaluated individuals' discourse contributions over the entire curriculum to explore a potential association between changes in students' discourse contributions and role formation. As students established roles, their contributions became more consistent. Dependent-sample *t*-tests were used to compare frequencies of student discourse contributions during simulations at beginning, middle and end time points of the unit (Sim1, Sim7, and Sim14, respectively). Results of *t*-tests are shown in Table 2. Amy and Michael contributed more from the beginning of the unit to the midpoint and from the midpoint to the end, but these increases were not significant (p = .074 and p = .388; p = .428 and p = .359, respectively). Sandra significantly increased her contributions from the beginning to the midpoint (p = .035) and continued to increase her contributions at a non-significant level in the second half (p = .616). Scott was the exception; despite a significant increase in contributions in the first half of the unit (p = .022), he contributed significantly less in the second half (p = .048).

Table 2: Dependent-sample t-test results for frequency of discourse contributions over time

Student	**Paired Simulations**	**Mean**	**Std. Dev.**	**Std. Error of Mean**	***t*-statistic**	**df**	**Sig. (2-tailed)**
Scott	Sim1-Sim7	-7.667	5.750	2.348	-3.266	5	0.022*
	Sim7-Sim14	6.333	5.955	2.431	2.605	5	0.048*
Amy	Sim1-Sim7	-5.000	5.441	2.221	-2.251	5	0.074
	Sim7-Sim14	-5.000	12.946	5.285	-0.946	5	0.388
Michael	Sim1-Sim7	-3.500	9.935	4.056	-0.863	5	0.428
	Sim7-Sim14	-6.167	14.945	6.101	-1.011	5	0.359
Sandra	Sim1-Sim7	-5.333	4.546	1.856	-2.874	5	0.035*
	Sim7-Sim14	-2.000	9.165	3.742	-0.535	5	0.616

*Result is significant at $p < 0.05$

We also evaluated whole-group discourse patterns over time. Frequency of contributions to different discourse types varied over time. Figure 2 represents how contribution frequencies changed over the curriculum (shown by Discourse Type; see Appendix). Reports were the most regularly contributed conceptual discourse type throughout the curriculum (326 turns). Conceptual Explanations were given more often in the first half and near the end, while Science Practices Explanations were mostly given at the end. Predictions were made more often in the first half of the curriculum; a similar pattern exists for Conceptual Questions. Monitoring, Agreement/Acceptance and Disagreement were procedural discourse types contributed with near-constant regularity. Social discourse was present mainly as Off-Task discussions. Statements of Conflict increased towards the end. The Initiating and Following contribution patterns indicated that students rarely continued a conversation topic for an extended period of time but frequently started new topics of discussion instead.

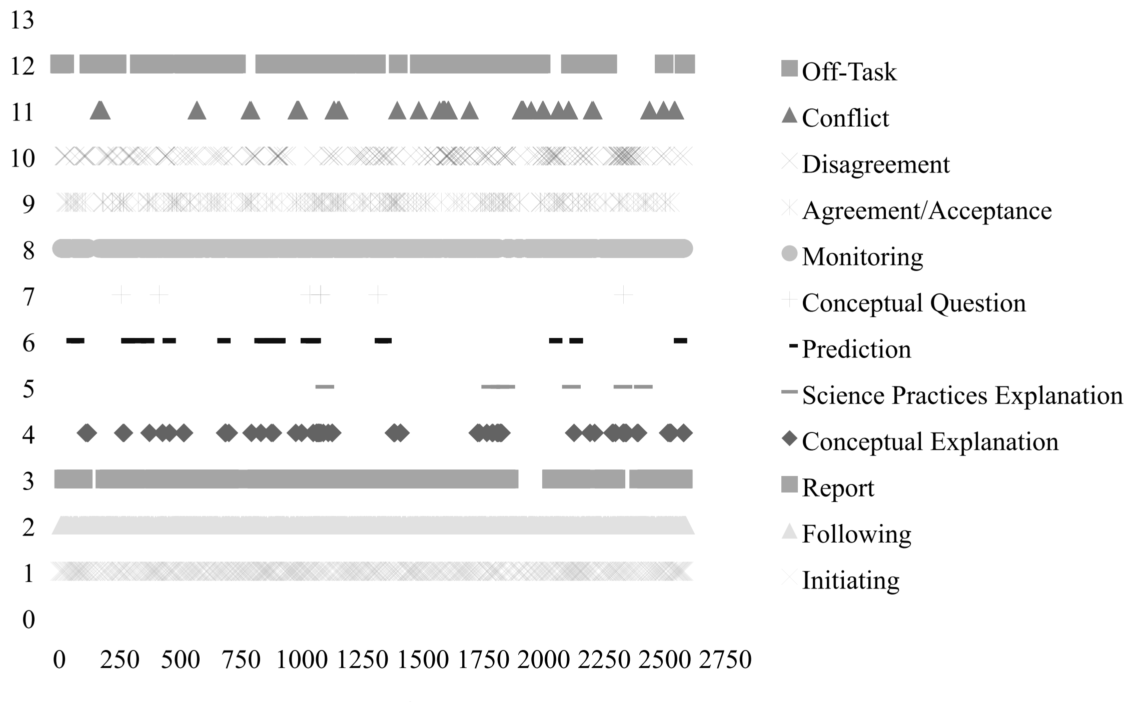

Figure 2. CORDTRA diagram showing whole group discourse contributions over 12 weeks

Summary of emerging roles

Overall, Michael emerged as the conceptual guide while Sandra managed the technology component and assumed procedural duties. Scott contributed to social discussion, primarily as continued engagement in off-task topics. Amy did not contribute a specific type of discourse but actively participated in conceptual and procedural discussions. Excerpts from the transcripts reflect this pattern (see below). Michael actively initiated and participated in conceptual discourse by predicting or explaining patterns in the data. Amy requested elaborations and justifications from Michael while aiding Sandra in maintaining group focus on the task. Scott listened to group debate and contributed his opinion when not participating in social discourse. The following excerpts are illustrative of the emergence of Michael's conceptual role, Sandra's manager role, and Amy's negotiation of experiment input values:

Excerpt 1

Michael:	It's going to be 3. 3.4 newtons.
Amy:	Wait, how many [joules] do you think it'll be?
Michael:	3.49 newtons. 3.49 newtons! It's going to be 3 joules. Going to be 3 joules. It's going to be – aww, what? 2.9.

Excerpt 2

Amy:	I think we should do 3 anyway.
Michael:	I think we should do 2.5. That works.
Sandra:	It's not going to help if we take a vote. It's going to be two on two.
Michael:	'Cause 3 just stopped it too fast. It's not fair. It's not scientific-y.
Amy:	Let's just do it.
Michael:	No, it's not fair. Why do you guys think it's 3?
Amy:	Because, um, it takes, um, less [unintelligible] and less track to stop it and it's still safe and efficient.
Michael:	2.5 was more efficient. Uh, 2.5 is more safe, and it still doesn't take that much track.

Excerpt 3

Michael:	The velocity is going to be 4.43 m/s.
Amy:	Right?
Michael:	Work?
Sandra:	Yeah.
Michael:	Work. It's going to be 4.43 m/s. Yeah. And then the kinetic energy and the [total] mechanical energy at the bottom will be 5.9. I called it. I'm done. The velocity for all of them – it's just going to be 4.43 J. I mean 4.43 m/s. And then the kinetic energy is total final energy at the bottom is going to be the same as initial P.E. and total initial energy.

Learning outcomes

Learning outcomes were evaluated because of the potential impact of collaboration quality on learning gains. Pre- and post-measures of physics conceptual understanding were assessed with the Physics Fiesta test. Learning gains were calculated first as pre-post differences and then as percentages (difference in score was divided by the initial score). Michael experienced the greatest learning gain (~77%). Scott and Amy also showed learning gains (~11%) despite contributing mainly to non-conceptual discourse. Sandra demonstrated a loss of learning of approximately 17%.

Discussion

This study investigated how discourse in a collaborative small group shaped role emergence and how adoption of emergent roles impacted learning gains for each student. Using a small sample allowed fine-grained analysis of ethnographic data collected over multiple weeks of an entire unit, permitting generation of holistic student profiles.

Roles emerged over time as a result of individual contributions to group discourse. Each student demonstrated a dominant discourse type evidenced by proportions of discourse contributions (see Table 1 & Figure 1). The initiation and uptake of discourse topics also revealed student-specific patterns related to role differentiation. Students may have contributed more frequently to particular discourse types because of personal interest or proficiency in a specific responsibility or content area (Strijbos & Weinberger, 2010). For example, a student interested in conceptual relationships may state unsolicited hypotheses regarding what will happen next in an experiment. As students performed discourse moves, the group underwent a dynamic process of talk differentiation and distribution (De Wever et al., 2010; Hoadley, 2010). The performance and adoption of certain discourse moves by individuals over time structured group interactions and initiated role emergence (Strijbos & Weinberger, 2010).

Students' consistent patterns in discourse participation shaped role formation (Hoadley, 2010). As students adopted roles, the roles reinforced their discursive tendencies, especially in initiation and uptake of discussion topics. This reinforcement resulted in a stabilization of discourse contributions and thus persistence of roles through the end of the curriculum (De Wever et al., 2010). The dependent-sample *t*-tests indicated that a process of initial role formation and subsequent stabilization occurred via individual discourse contributions over time. Michael's non-significant increase in contributions indicated that he immediately established his role as conceptual guide. The other students showed greater increases in contributions in the first half of the curriculum, indicating a responsive role differentiation stage (De Wever et al., 2010; Hoadley, 2010). The lack of significant increases in the second half of the curriculum indicated role stabilization. The decline in mean contributions for Scott and Michael may be due to a discouragement of social discourse as the group became more task-oriented. Figure 2 shows largely consistent patterns in whole-group discourse contributions with the exception of relatively rare conceptual discourse types. This likely resulted from the undertaking of conceptual talk by a single student (e.g. Michael), indicating that conceptual discourse was role-specific in this case. The consistency in procedural contributions may have reflected an urgency to complete the task in limited time.

Although the sample size of this study is too small to make claims about learning gains, the emergence of specific roles for each student may be related to learning gains or losses. Michael verbalized observations, explanations, and other types of conceptual discourse; he also experienced the greatest learning gain. Sandra, on the other hand, managed the technology for the group in each session while planning the task and negotiating input values. Her narrow focus on the task may have limited her participation in conceptual discourse, possibly contributing to her learning decrease on the conceptual assessment. Interestingly, both Scott and Amy showed modest learning gains despite Scott's participation in social discourse and Amy's balanced participation in all discourse. Overall, this discourse-role-achievement pattern aligns with the findings of Gu et al. (2015); the functions of particular roles lend themselves to variable conceptual achievement, with task management roles resulting in lower achievement. The initiation and uptake patterns also indicated short discussion lengths throughout, which may have limited potential conceptual gains.

Unfortunately procedural discussion pertaining to experiment planning and negotiation of input values predominated over conceptual talk. These findings align with those of Strijbos et al. (2005), who found that role behavior emerged through task planning instead of discussion of relevant concepts and principles. The preponderance of procedural talk may have reduced contributions to conceptual discourse because of limited session time, forcing conceptual and procedural ideas to compete for student attention. Students may have faced a dilemma between exploring data patterns and completing the assigned task. With limited time, students enacting the manager role may prioritize procedural discourse over exploratory conceptual talk out of necessity; their participation in conceptual discussion is reduced as a result. This limitation could be evenly distributed among group members so no one student is limited in conceptual discussion. Future implementations could a) expedite negotiation of experiment inputs by requesting justifications in advance, and b) schedule rotation of the technology manager role if single-student manipulation is stipulated (Strijbos & Weinberger, 2010; Gu et al., 2015). Spada (2010) has summarized alternatives to role rotation, such as intentional distribution of expertise.

The primary limitation of this study was the small sample size, which reduced the availability of parametric testing and limited generalizability. This study was designed to be an in-depth analysis of a single group's emergent role process, but future studies with multiple groups could determine if the pattern between emergent roles and learning outcomes is consistent. Replication could reinforce the association between observed discourse patterns and emergent roles and support a potential link between role differentiation and learning gains. Comparison groups should include students of greater diversity in demographic backgrounds; our current study is limited in generalizability in that regard. Additionally, the assessment for physics conceptual understanding may have not captured full learning gains from the implementation as it was administered at the end of the school year and did not impact school grades, potentially altering the level of motivation or cognitive effort expended by students on this post-measure.

Implications and conclusion

The implications of this study mainly relate to the debate surrounding scripting of roles (Hoadley, 2010; Strijbos & Weinberger, 2010; Spada, 2010; De Wever et al., 2010; Strijbos & de Laat, 2010). CSCL environments are engineered to foster equal participation, but this may not occur for many reasons. While there are multiple studies of how to optimize scripting for collaborative groups, our study's focus on emergent roles in face-to-face technology-enhanced collaboration is unique. Students in CoMPASS classrooms are familiar with each other and have pre-existing perceptions or expectations of one another; these attitudes may influence the social reinforcement of emerging roles and discourse moves. These interactions are crucial to knowledge co-construction and should be facilitated so that students have equal opportunities to act in each role, at least temporarily, before role stabilization occurs. By rotating the roles within the group, especially those involving control of technology resources, we may improve the distribution of learning gains for group members. Further investigations into processes of role formation provide opportunities for curriculum designers to differentiate and distribute roles in ways that maximize collaboration benefits for each student.

References

Bruhn, J. (2000). *Förderung des kooperativen Lernens über Computernetze* [Facilitation of cooperative learning via computer networks]. Frankfurt am Main: Lang.

De Wever, B., Van Keer, H., Schellens, T., & Valcke, M. (2010). Roles as a structuring tool in online discussion groups: The differential impact of different roles on social knowledge construction. *Computers in Human Behavior, 26* (4), 516-523.

De Winter, J. C. F. (2013). Using the Student's *t*-test with extremely small sample sizes. *Practical Assessment, Research & Evaluation, 18(10).* Available online: http://pareonline.net/getvn.asp?v=18&n=10.

Gu, X., Shao, Y., Guo, X., & Lim, C. P. (2015). Designing a role structure to engage students in computer-supported collaborative learning. *Internet and Higher Education, 24*, 13-20.

Hare, A. P. (1994). Types of roles in small groups: A bit of history and a current perspective. *Small Group Research, 25*, 443-448.

Hmelo-Silver, C. E., & Barrows, H. S. (2008). Facilitating collaborative knowledge building. *Cognition and Instruction, 26*(1), 48-94.

Hmelo-Silver, C. E., Liu, L., & Jordan, R. (2009). Visual representation of a multidimensional coding scheme for understanding technology-mediated learning about complex natural systems. *Research and Practice in Technology Enhanced Learning, 4*(3), 253-280.

Hoadley, C. (2010). Roles, design, and the nature of CSCL. *Computers and Human Behavior, 26*(4), 551-555.

Jahnke, I. (2010). Dynamics of social roles in a knowledge management community. *Computers and Human Behavior, 26*(4), 533-546.

Jones, A. & Issroff, K. (2005). Learning technologies: Affective and social issues in computer-supported collaborative learning. *Computers and Education 44*(4), 395-408.

Puntambekar, S., Stylianou, A., & Goldstein, J. (2007). Comparing enactments of an inquiry curriculum: Lessons learned from two teachers. *The Journal of the Learning Sciences, 16*(1), 81-130.

Sarmiento, J. W. & Shumar, W. (2010). Boundaries and roles: Positioning and social location in the Virtual Math Teams (VMT) online community. *Computers in Human Behavior, 26*(4), 524-532.

Spada, H. (2010). Of scripts, roles, positions and models. *Computers in Human Behavior, 26*(4), 547-550.

Strijbos, J. W. & De Laat, M. F. (2010). Developing the role concept for computer-supported collaborative learning: An explorative synthesis. *Computers in Human Behavior, 26*(4), 495-505.

Strijbos, J. W., De Laat, M. F., Martens, R. & Jochems, W. (2005). Functional versus spontaneous roles during computer-supported collaborative learning. In T. Koschmann, D. D. Suthers, & T. W. Chan (Eds.), *CSCL 2005: The next ten years* (pp. 647-656). London, UK: Routledge.

Strijbos, J. W. & Stahl, G. (2007). Methodological issues in developing a multi-dimensional coding procedure for small-group chat communication. *Learning and Instruction, 17*(4), 394-404.

Strijbos, J. W. & Weinberger, A. (2010). Emerging and scripted roles in computer-supported collaborative learning. *Computers in Human Behavior, 26*(4), 491-494.

U.S. Department of Education. Institute of Education Sciences, National Center for Education Statistics. (2013). *Glacial Drumlin School*. Retrieved from http://nces.ed.gov/ccd/schoolsearch/school_detail.asp?Search=1&SchoolID=550981001293&ID=550981001293.

Van Aalst, J. (2009). Distinguishing knowledge-sharing, knowledge construction and knowledge-creation discourses. *Computer-Supported Collaborative Learning, 4*(3), 259-287.

Woods, D. and Fassnacht, C. (2014). Transana v2.61. http://www.transana.org. Madison, WI: The Board of Regents of the University of Wisconsin System.

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Appendix

Table A1: Two-Dimensional Coding Scheme for Student Discourse Analysis

Discourse Action	**Description**	**Example**
Initiating	Issuing a statement or question intended to begin a conversation about a specific topic.	"Who's going to be the group leader today?"
Following	Following an initiation statement or question that continues the conversation about the same topic.	"If yours is confirmed, then mine is confirmed."
Discourse Type	**Description**	**Example**
Conceptual		
Report	Statements that indicate observations and interpretations of data at a superficial level, including definition, hypotheses, confirmation of predictions, and opinions without reasoning.	"We don't have any kinetic energy."
Conceptual Explanation	Statements that indicate reasoning, elaboration or clarification, justification, or proposition of a relationship between concepts.	"I just like say velocity is dependent on speed."
Science Practices Explanation	Statements that indicate non-conceptual reasoning for suggestions; they must be rooted in the scientific method.	"I was thinking about doing 0.3, 0.6, [and] 0.9 because we did a lot of 0.2, 0.4 [and] 0.6."
Conceptual Question	Questions that are designed to seek information or request an explanation or clarification regarding concepts.	"Wait, how many [joules] do you think it will be?"
Prediction	Statements that predict a particular outcome, such as a dependent variable value.	"It's going to be zero joules for the rest of them."
Procedural and Negotiation		
Monitoring	Statements or questions related to planning the task process, including preparing the simulation, requesting suggestions, making suggestions (including alternatives), seeking consensus, making and verifying decisions, refocusing group members, restating task constraints, and group policing.	"Okay, should we go with 0.25 kilograms?"
Agreement	Statements indicating a shared opinion and/or understanding (Van Aalst, 2009) or acceptance of another's opinion.	"I like it, I like it."
Disagreement	Statements indicating a difference in opinion or understanding (Van Aalst, 2009).	"No, they're not."
Social		
Conflict	Statements or questions indicating group dynamics, specifically criticism of peers or the task process.	"I never get a say in anything."
Off-Task	Statements or questions regarding topics unrelated to task concepts or procedures.	"Orange juice. Mmm. Would you like some [orange juice]?"

