

## Eye-Rollers, Risk-Takers, and Turn Sharks: Target Students in a Professional Science Education Program

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**Abstract:** In classrooms from kindergarten to graduate school, researchers have identified target students as students who monopolize material and human resources. Classroom structures that privilege the voice and actions of target students can cause divisive social dynamics that may generate cliques. This study focuses on the emergence of target students, the formation of cliques, and professors' efforts to mediate teacher learning in a Master of Science in Chemistry Education (MSCE) program by structuring the classroom environment to enhance nontarget students' agency. Specifically, we sought to answer the following question: What strategies could help college science professors enact more equitable teaching structures in their classrooms so that target students and cliques become less of an issue in classroom interactions? The implications for professional education programs in science and mathematics include the need for professors to consider the role and contribution of target students to the learning environment, the need to structure an equitable learning environment, and the need to foster critical reflection upon classroom interactions between students and instructors. © 2006 Wiley Periodicals, Inc. *J Res Sci Teach* 43: 819–851, 2006

Jill [a pseudonym] really dominated [chemistry] class today, speaking 24 times in 30 minutes. She'd ask a question and then answer it. She took the liberty of explaining to those around her what the TA was explaining at the board. At one point, she suggested he try explaining the problem in a different way, and then offered to come to the board to explain it for him. At first students were laughing at her tenacity, but they eventually fell silent. Chris, a recent chemistry graduate, began rolling his eyes as she spoke and two other high-achieving females began passing notes to one another and smiling each time she

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spoke, indicating the notes and laughter were directed at Jill—who remained oblivious to everything around her. (Martin, field notes, cohort 4, 7/8/03)

Jill is an example of a target student. Target students are present in most classrooms. They dominate discussions and receive a disproportionate amount of the teacher's attention. Sadker and Sadker (1985, 1994) reported in their study of 100 fourth-, sixth-, and eighth-grade classrooms across four states and Washington, DC, that a few students accounted for 50% of classroom interactions, more than three times their proportional share, whereas 25% of students did not participate at all. In Australian high school science classes, Tobin and Gallagher (1987) found that three to five target students monopolized whole-class interactions. Typical target students were high achieving, usually male and white, who were extensively involved in classroom interactions by responding to teacher questions, asking questions, and providing information (Tobin, 1988). Teachers reported that not only were they aware of target students (sometimes called teacher's pets), but they often purposely used target students to answer more difficult questions in order to keep instruction moving and to achieve their lesson goals (Tobin, 1988). A second type of target students, called risk-takers, were active-participants who self-initiated interactions. They engaged in activities, such as calling out and raising their hands, which advantaged them over other students for the teacher's attention. Since these initial studies, the existence of target students has become part of the lore of classroom interactions in schools (Jones, 1990; Wu, Krajcik, & Soloway, 2001).

Studies of target students indicated that specific activity structures influenced their behaviors, and that of their teachers, by encouraging different patterns of classroom engagement. Tobin and Gallagher (1987) identified four distinct activity structures when examining classrooms: noninteractive lecture; whole-class interactive lecture; small-group work; and individualized work. In their search for patterns of classroom interaction, Tobin and Gallagher (1987) focused on the whole-class interactive structure and student engagement. In this arrangement, only one student could engage in an overt manner at a given time, and teachers and target students often ignored other students. Further investigation of students' opportunities to participate and their inclination to engage in or avoid these interactions led Tobin and Gallagher (1987) to conclude that the lesson's content, along with teacher and student expectations regarding the students' social and cultural capital, influenced the extent to which target students participated in classroom interactions. Target students acquired social and cultural capital at their peers' expense by dominating the human resources in discussions (e.g., teacher's attention), and material resources (e.g., equipment) in activities such as labs.

For example, as a female, Jill is an atypical, but not unique, target student in a college chemistry course, and she represents a contradiction to the pattern in which males are most likely to emerge as target students (Thomas, 1990; Tobin, 1988; Tobin & Gallagher, 1987). In examining the role of target students in a graduate-level chemistry course for in-service high school teachers, we observed a small group of teachers (some of whom we identified as target students) who deliberately physically isolated themselves from their peers, while continuing to dominate classroom interactions. These teachers had formed a clique.

### Cliques

Our class started to form cliques over the summer, and it took away from the learning process. There were some people who were rude to others, and there were rumors of people in the back of the classroom making fun of people in the front of the classroom when they asked a question or got a problem wrong. . . .It started to feel like I was in middle school again. (Tina, cohort 2 member, e-mail correspondence, spring 2003)

Classroom structures that privilege target students may support the formation of cliques. Cliques are a select group of people that maintain high social and cultural capital in a given field. In their study of preadolescent girls, Adler and Adler (1998) described cliques as friendship circles that are hierarchical, dominated by leaders, and exclusionary. Clique members recognize the boundaries between themselves and others and use nonverbal and verbal strategies to ensure that others respect and remain outside of the group. The formation of cliques within a classroom can further marginalize some students (including some clique members) by diminishing their access to human (i.e., teacher and other students) and material (i.e., access to laboratory equipment, chemicals) resources. This limited access to resources can have negative outcomes for non-clique students' learning. We applied this definition of a clique in our study.

### Significance of This Research

Researchers have identified the emergence of target students and cliques in studies of middle and high school students (Adler & Adler, 1998; Cline, 1986; Jones, 1990; Tobin, 1988; Tobin & Gallagher, 1987), but researchers have not investigated if these interaction patterns occurred in graduate-level courses or professional education programs for teachers. As evaluators of a Master of Science in Chemistry Education (MSCE) program (a content-specific professional education program) our focus was to consider overt measures, such as participant satisfaction with the program and the learning of the participants. Working with practicing teachers, we had not expected to be studying the development of clique behaviors resulting from the presence of target students. However, when we recognized the detrimental impact these cliques were having on the learning environment, we began to analyze previously recorded classroom interactions and field notes, and conducted interviews to ascertain how and when these groups formed in an attempt to ameliorate the negative effects cliques had on classroom interactions. In this investigation, we examine the emergence of target students in a graduate program for teachers. The program uses a cohort model. Within this study, we explore an unsupportive clique that emerged in one cohort and we propose pedagogical strategies for college professors to promote equitable classroom environments. The following questions guided our research:

- How did enacted program structures encourage the emergence of target students and cliques in these graduate-level courses?
- What conditions contributed to the formation of cliques and how important are target students to this formation?
- What strategies could help college science professors enact more equitable structures in their classrooms so target students and cliques become less of an issue in classroom interactions?

The final research question is particularly salient as professional education programs for teachers increasingly include content courses taught by science faculty. Following the release of *A Nation at Risk*, policymakers implemented a series of systemic approaches to reform American teachers' professional education programs to provide sustained, on-going experiences where teachers engage with both science content and pedagogical innovations (Clewell, Hannaway, Cosentino de Cohen, Merryman, Mitchell, & O'Brian, 1995; Kahle, in press; National Commission on Excellence in Education, 1983). To support these innovative changes, the National Science Foundation (NSF) funded a series of large projects directed toward systemically reforming mathematics and science education with a major goal being the improvement of teachers' content knowledge. In their recent report, the Committee on Prospering in the Global

Economy of the 21st Century (2005) recommended that the highest priority for funding and support be assigned to programs:

Science and Mathematics master's programs: Provide grants to universities to offer 50,000 current middle-school and high-school science, math, and technology teachers (with or without science, math, or engineering degrees) 2-year, part-time master's degree programs that focus on rigorous science and mathematics content and pedagogy over a 5-year period. The model for this recommendation is the University of Pennsylvania Science Teachers Institute. (Committee on Prospering in the Global Economy of the 21st Century, 2005, p. 4)

Such programs are designed to provide teachers with rigorous content-based instruction in tandem with teacher education courses in an attempt to build competent science teachers. The science faculty instructing these specialized content courses traditionally learn to teach while serving as graduate student assistants for lecture and lab courses and, as such, these faculty often develop their teaching praxis in the absence of educational research related to pedagogy in science education. Although this is not necessarily problematic, several studies (Felder, 1993; Seymour, 1992; Seymour & Hewitt, 1997; Tobias, 1990) have indicated that students' learning experiences (especially those of women and racial minorities) in courses taught by college science faculty led to increased attrition rates in these courses and in science careers. These trends in professional education for science teachers are significant if content courses are taught by faculty members who use the same instructional methods that "weed out" students from introductory-level science courses (Seymour, 1992; Tobias, 1990). That the majority of the students who leave these science courses are from underrepresented groups would only serve to compound the existing problem of recruiting teachers of color into K-12 science education (Ladner & Hammons, 2001; Swartz, 2003; Villegas & Clewell, 1998). These findings suggest a need for increased dialogue among science and education departments to address such issues as science faculty become more involved in science teacher education programs.

### Context of the Study

This study occurred within a Master of Science in Chemistry Education (MSCE) program at a large, private research university. The MSCE program is a collaborative effort between the university's Chemistry Department and the School of Education that focuses on improving teachers' chemistry content knowledge. Experienced faculty members, from both the Chemistry Department and School of Education, taught the program's eight specially designed chemistry courses and two chemistry education courses.

Taught over three 8-week summer sessions and the two intervening fall/spring semesters (Fig. 1), each professor used inquiry-based instruction, complex questioning, and collaborative learning as instructional strategies. Although the overall program emphasized improving teachers' discipline knowledge, the education courses during the academic year were designed for teachers to incorporate the program's pedagogical approaches into their high school science classes. As such, teachers were also encouraged to reflect on and change their teaching practices.

The program began with 20 teachers in the summer of 2000, and added a new cohort each subsequent summer. This study used data from four MSCE cohorts involving 77 teachers and 15 professors. Whereas all MSCE applicants had successfully completed at least two semesters of undergraduate chemistry, some teachers exceeded this requirement and held degrees in chemistry and/or had research experience in chemistry. The teachers enrolled in MSCE also had differing amounts of teaching experience, ranging from less than 3 years to over 30 years.

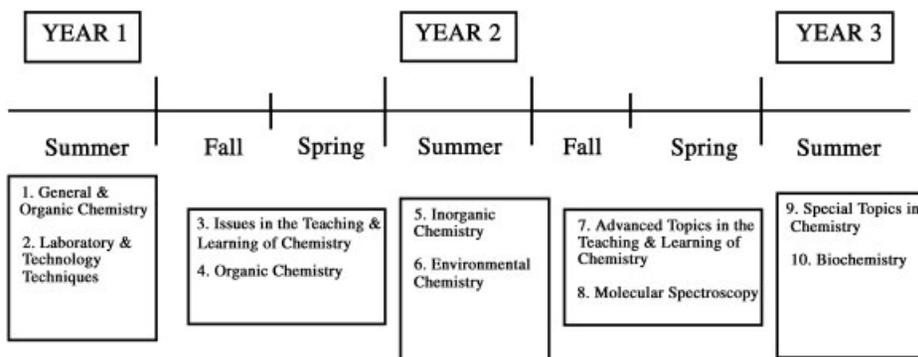


Figure 1. Organization of courses in the Master of Science in Chemistry Education (MSCE) program.

We began collecting data in summer 2000 when Sonya was a teacher-participant in the first cohort. After her graduation, Sonya was employed as an evaluator for the program. As such, she brought an *emic*, or insider, perspective to the study. Both Catherine and Kathryn were professors and researchers who had an *etic*, or outsider, perspective in the data collection and analysis.

#### Introduction to Theoretical and Methodological Perspectives

By integrating the methodological frameworks of critical ethnography and video analysis at differing levels within the theoretical framework of cultural sociology, complex social interactions can be analyzed, identified, and categorized into patterns of interactions that enable us to make claims about classroom interactions in relation to different forms of capital. Within this study, we interweave different vignettes, video and transcript analyses (at the meso, micro, and macro levels), field notes, observations, excerpts from interviews, and other data resources to provide evidence for both general and specific claims we make regarding coherent patterns of social interactions among participants in relation to the forms of capital possessed and valued by these participants in the field of the MSCE program. Identification of these patterns of coherence and contradictions (instances in which what we expect to see is not observed) enable us to make reasonable claims regarding the impact of target students and cliques on the learning environment in this professional program for science educators. Identification of these patterns enabled us make changes, along with professors, administrators, and teachers, to the structure of the MSCE program in an effort to expand the agency of participants who were negatively affected by these target students and clique members. By altering the program structure, we were able to create a more cohesive and supportive learning environment for all participants.

#### Theoretical Framework

Cultural sociology is useful for examining how the MSCE program structures' afforded teacher agency, which is defined as the power to act—that is, to access and appropriate resources in order to reach one's goals (Sewell, 1992, 1999). Structure and agency exist in a dialectical relationship so that classroom structures impact the agency of each teacher and teacher agency can change classroom structures. In addition, this framework provides an effective means to examine how a teacher's cultural, social, and symbolic capital (Bourdieu, 1986, 1992; Sewell, 1992, 1999) affords his or her classroom practices. A teacher's agency depends upon her cultural capital (e.g., chemistry knowledge), social capital (e.g., support networks, social contacts and friendships), and symbolic capital (e.g., a chemistry degree). In this study, culture is viewed as the interconnection

of chemistry/science knowledge, rules, dispositions, and associated practices within the field of the MSCE program (Swidler, 1986). A field is a temporal and spatial structure where participants enact the cultural, social, and symbolic capital that they possess. Coupled with cultural sociology, critical ethnography provides a necessary methodology with which to analyze culture in terms of the structure/agency dialectic briefly introduced earlier. The intersection of these different frameworks is explained in detail in the following sections.

In this study, cultural capital is associated with a teachers' science knowledge because it is this knowledge that equips her with the competence to decipher cultural artifacts and processes enacted by other social agents (Bourdieu, 1984); that is, the ability to recognize the capital held by other teachers in the class by their performance on chemistry quizzes and tasks in class. Symbolic capital is associated with accumulated prestige based on knowledge and recognition. A teacher can accumulate symbolic capital if others recognize her chemistry knowledge and expertise. However, in any given field, including MSCE, these forms of capital are difficult to quantify because participants working individually and collectively within these fields shape these constructions. These constructions are social and do not reside in an individual. It is an individual's interaction with social groups, in this case with other teachers and with professors, that leads to the attribution of cultural, symbolic, and social capital, which can be identified, analyzed, and categorized using cultural sociology and critical ethnographic methods.

Consider the cultural, social, and symbolic capital possessed by a Nobel Prize-winning chemist. This accomplishment, however significant in some social settings, would garner little accolade if this person were placed in a setting where this accomplishment was not recognized as valuable. For example, on a middle school playground, being skilled at double-dutch or playing basketball would garner a person more social and symbolic capital than being knowledgeable about chemistry. Possessing the cultural knowledge of how to play basketball or jump double-dutch are examples of resources that are not material in nature. As such, the different forms of capital are viewed as possessing different resources that afford the practices that a teacher can enact, based on the capital she possesses and the capital that is valued by others within that particular field. These constructs are useful when considering participant interactions in terms of the structure/agency dialectic.

Prior to admission to the MSCE, each cohort member had dispositions that led her to apply for admission. The program's administrators then evaluated teachers' written applications and interviews based on criteria such as chemistry knowledge and teachers' potential as legitimate participants to engage in chemistry education. Teachers were willing to invest the capital they brought with them to be successful in this new field. We assumed, and the entrance interviews indicated, that all teachers entered the MSCE with the intent to successfully complete the program. However, each participant was constructed in terms of the capital she was seen to possess by other social agents in the program and this construction had implications for the emergence of clique and target student behaviors.

### Methodology

Critical ethnography is used as a methodological framework for this study because it provides, through the eyes and voices of study participants, a means of identifying, documenting, and analyzing the enacted culture and strategies of teachers and professors (Barton, 2001; Kincheloe & McLaren, 1994; Lather, 1986). In addition to generating new knowledge, critical ethnography enabled us to create a learning environment where professors and teachers actively and meaningfully participated in the research. The methodological design provided opportunities for all participants (including professors, teachers, administrators, and evaluators) to examine and

to compare their program experiences, which Guba and Lincoln (1989) referred to as *ontological authenticity*. The triangulation of participant perspectives provides opportunities for *educative authenticity*, such that participants developed an awareness of, and empathy for, others' constructions as they implemented their learning into their teaching. An on-going goal of the evaluation was that course instructors, teachers, and administrators would demonstrate *catalytic authenticity* via their involvement in making decisions about how to transform the program and by taking responsibility for making change based on the findings of the evaluation (Guba & Lincoln, 1989).

This was particularly significant in one professor's chemistry education course, because, after identifying target student behaviors, he enacted teaching strategies to minimize the effect of target students on the class environment and peer interactions within the cohort. Associated with catalytic authenticity was *tactical authenticity*, which is a requirement for researchers to make efforts to assist all participants to benefit from the research (Guba & Lincoln, 1989). Thus, researchers have a responsibility to help those who cannot readily help themselves—to provide structures to expand the agency of all to benefit from the research.

### Data Sources and Collection

Data sources included texts (e.g., transcripts, field notes, interviews), digital photographs, videotapes of classes, and artifacts (e.g., student work samples, handouts, official documents). Adhering to the authenticity criteria, a variety of participant perspectives were employed for data collection and analysis, including those from professors, evaluators, teaching assistants, and teachers. For anonymity and clarity, all proper names (other than the researchers and the chemistry education professor with whom we enacted the structural changes reported in this study) are pseudonyms and MSCE teacher-participants are referred to as teacher(s) or target students.

### Video Analysis

The videotapes were a “renewable” data source, which provided authors access to the same data when analyzing classroom dynamics and microinteractions between the teachers, professors, laboratory assistants, and technicians (Kemper & Collins, 1990). This was especially important in this study because the videotapes provided data resources accessed retrospectively to identify target students and to document the development of clique behavior. Video analysis included a study of the selected vignettes at both normal and slow speed. iMovie provided a mechanism to view teacher and professor practices at different speeds (e.g., fast forward and reverse, frame-by-frame, super-slow). Time manipulation of the video clips provided details of the classroom events, including subtleties and patterns in target student practices. At normal speed, the video clips provided a meso-level perspective of the classroom interactions, where *meso* refers to events, which unfold in real time. Slowing the videotape to play at intervals as small as hundredths of a second is an example of *micro*-level analysis, which enabled the researchers to analyze nonverbal interactions and the microinteractions between people. Microinteractions are based on power, which are important constructs for making sense of the practices and associated dispositions of target students (Kemper & Collins, 1990).

### Data Analysis

We began data analyses by using videotape to explore and describe meso-level interactions between professors and teachers in real time, or normal speed, which allowed us to develop a broad

understanding of class activities. Next, we identified and selected vignettes for micro-level analyses in which we slowed the tape speed for detailed examination of practices. This enabled us to categorize target students' practices as well as the nonverbal interactions and practices of their professors and peers. Videotape analysis, supported by interviews, field notes, and observations, showed that both target students and cliques existed in each cohort.

Analysis of varied data resources over time enables researchers to make *macro*-level claims about patterns that persist over time and in varied settings and during different types of social interactions. These methods enabled us to identify and categorize various forms of capital held by different program participants, as well as to identify differing types of target student practices and a variety of classroom interactions involving clique members, target students, and their peers and professors. As a result, we used vignettes from several cohorts to support general claims about target student and clique behaviors at both the macroscopic and mesoscopic levels. However, we focused our analysis of clique development on the second cohort because of the emergence of a powerful, insular, and detrimental clique. We employed microscopic analysis on specific events occurring between teachers in the second cohort to provide evidence of specific disrespectful, nonverbal behaviors. Although it was not immediately obvious, this clique had a negative impact on the teachers who experienced the dismissive and disrespecting behaviors from both the clique members and from the other cohort members who sought clique acceptance and membership.

#### Video Analysis and Member-Checking Procedures

When this research commenced, the first cohort of teachers was completing the final summer of the program, the second cohort was in their second summer, and the third cohort was in their first summer. The researchers initially identified target students and cliques through anecdotal evidence from classroom observations of cohorts 1 and 2. When researchers reviewed videos of previously recorded classes for cohorts 1 and 2 to substantiate this claim, they observed evolving patterns in teacher seating preference, inequity of teacher speaking patterns in whole-class and small-group interactions, and increasingly overt displays of disinterest and disrespect when teachers who were characterized through our analyses methods as having low social and cultural capital spoke in whole-class settings. This information led us to focus our future data collection on teacher interactions in cohort 2, specifically among the clique exhibiting those behaviors.

Following cohort 2 into the intervening fall/spring and summer semesters, Sonya collected video from each class and mesoscopically analyzed for salient vignettes. Using iMovie, these vignettes were imported into QuickTime video clips that were transcribed and analyzed using both the mesoscopic and microscopic analysis methods described in the previous section. The vignettes were transcribed using a series of discourse conventions (Wortham, 2001) outlined in the Appendix. These conventions enabled analysis of a variety of discourse situations that provide information about cultural interactions and practices at both the meso and micro levels, which we use to make claims concerning the forms and relative amounts of capital held by different participants in differing fields (such as the chemistry or chemistry education classrooms). Based on analyses, general patterns involving target student practices and clique behaviors emerged.

Reviewed by all three researchers and the professor of the Chemistry Education course in which cohort 2 teachers were enrolled, the negative classroom interaction in these vignettes established the need for strategies to counteract the clique's negative impact on the classroom environment. Collaborative discussion between the professor and researchers resulted in our gathering feedback from cohort members on target student and clique behaviors through an anonymous survey and voluntary interviews.

Sociocultural theory has noted that people enact cultural practices both consciously and unconsciously. To make the teachers aware of their classroom practices, a variety of video clips, anonymous survey results, and transcribed interview responses were collected and presented to cohort 2 members in their chemistry education course as a member-checking session. During this activity, the teachers responded to the vignettes and provided their recollections and interpretations of their interactions. This member-checking practice of soliciting input from teachers regarding data collection and analysis adheres to each authenticity criterion outlined in the Methodology section of this study. Several vignettes from this session are included in this study to illustrate the catalytic potential of this methodological process.

### Cohort Members

MSCE adopted a cohort model to promote a community of learners. Requirements for acceptance into the program were flexible to ensure diversity of teaching experience, chemistry knowledge, and education knowledge. Table 1 shows the participant demographics including undergraduate majors, gender, and school placement.

The data presented in Table 1 suggest that the cohorts were similar. However, in cohort 2, three of the chemistry majors were young males. Two of these males taught at exclusive private high schools and the other at an elite high school with high-achieving students. These three men are the main target students and clique members discussed in this study. The other chemistry majors in this cohort included a fourth male teacher and several older women. To help the reader follow the narrative surrounding the video and audio transcripts interwoven throughout the rest of the text, Table 2 describes cohort teachers in conjunction with identified target student practices and clique membership status as determined by sociocultural analysis of a variety of data resources as described in the Data Analyses section of this study.

As explained earlier in the study (although difficult to quantify) relative levels of cultural, social, and symbolic capital among cohort members were discernible based on what each teacher brought to the program in terms of prior chemistry knowledge and teaching experiences. Analysis of a variety of data resources (including video and transcript analyses, interviews, anonymous surveys, field notes, observations, and member-checking sessions) enabled us to identify and categorize varying levels of capital held by cohort members in different fields based on their access to and appropriation of available resources during classroom interactions.

In the following sections we examine data from field notes, interviews, and video vignettes that illustrate the types of target students and cliques that inhabit the cohorts of this program. The reader is advised to refer to Tables 1 and 2 and to the Appendix when examining the video and

Table 1  
*Demographics of MSE cohorts*

Cohort	Major				Gender		School Sector				
	Chemistry	Biology/ Biomedicine	Physical Science/ Math and Engineering	Arts and fine arts	M	F	Urban	Suburban	Private	Parochial	Nonteacher
1	10	7	3	0	8	12	11	7	0	1	1
2	8	10	1	2	9	12	5	8	6		2
3	7	11	2	0	9	11	5	12	3		0
4	11	8	0	0	5	14	8	10	1		0

Table 2  
*Speakers organized by science background, teaching assignment, and position in cohort*

Group Affiliation	Name	Degree Information and Teaching Assignment	Position in Cohort
<i>Powerhouse members</i>	Todd	Undergraduate chemistry major. Young male. Taught chemistry and biology for 1 year at private school prior to entering program	Identified as a turn shark. Leader of clique
	Kevin	Undergraduate chemistry major. Young male. Taught honors and AP chemistry at an elite private school	Male clique member
	Sam	Undergraduate chemistry major. Young male. Taught honors chemistry at an elite private school	Male clique member
	Beth	Undergraduate biology major. Young female. Science education doctoral student. Nonteaching participant	Female clique member
	Lisa	Undergraduate engineering and math majors. Young female. Nonteaching participant	Female clique member
	<i>Wannabe</i>	Angel	Undergraduate chemistry major. Older female. Taught honors and advanced placement chemistry in a high-achieving suburban high school
<i>Disrespected students</i>	Marnie	Undergraduate education major. Young female. Taught in a low-achieving public urban high school.	Maintains social ties with a small number of cohort members—mostly female
	Bob	Undergraduate biology major. Older male. Taught in a high-achieving public high school	Maintains social ties with older male students, but generally sits alone in class
	Andy	Undergraduate biology major. Older male. Taught in a suburban school	Identified as a joker. Maintains social ties with a small number of cohort members, both male and female

audio transcripts. The Appendix provides a detailed account of the transcript conventions employed. The transcriptions throughout this article are divided into three columns: Actors, Happenings, and Actions. The first column provides information about the speaker. The second column provides a detailed account of both the verbal and nonverbal gestures occurring in tandem during the interaction. The third column highlights actions identified as being indicative of target student and/or clique member practices.

### Examining Interactions

Cohort participants quickly developed a sense of the ways in which individual cohort members interact, including those we identified as target students. This section draws on data collected across four cohorts before narrowing the lens to focus on several salient vignettes involving target student behaviors from clique members in cohort 2.

Risk-Takers, Networkers, Turn Sharks,  
and Jokers—Oh My!

Practices and activities associated with target students occur in the classroom (i.e., field). Jones (1990) argued that target students enact practices to gain and maintain social capital with their peers and/or teachers. Furthermore, target students may also develop cultural capital when enacting their strategies because they “try out” answers (Jones, 1990). Tobin (1988), however, reported that peers do not universally appreciate or accept target students. Thus, depending on the social context, target students may either gain or lose social capital with peers, while garnering social capital with their professors. Tobin (1988) also demonstrated that students recognize target students in classroom interactions, and MSCE students were no different:

In the beginning of the program, Tony was always participating in class, always raising his hand, and he was always right. He made it apparent to professors and students alike that he knew a lot about chemistry. Because chemistry was a sought after commodity in the program, he quickly set up a social network because people were seeking him out for his chemistry knowledge. After two and half years of Tony answering a disproportionate number of the questions, it became annoying and frustrating for many of us. Over time he took his power into other realms—acting as a father figure that scolded us for being late, being loud, or what he deemed as inappropriate behavior. (Claire, cohort 1 member, interview, 2002)

Our classroom observations and videotape analysis, supported by field notes and participant interviews, indicated that Tony demonstrated target student practices. His willingness to initiate and to answer questions marked him as a risk-taker. Initially, Tony’s risk-taking target student behavior increased his social and cultural capital. Video analysis, observations, and interviews with program participants provide evidence that these risk-taking practices were initially considered to be beneficial in that they prompted professors to clarify concepts, provided peers with alternative ways of thinking about problems, and even encouraged peer participation in classroom discourse. In general, Tony’s early contributions were regarded as positive. Even though Tony’s risk-taking behaviors continued to help him generate cultural capital in the form of chemistry knowledge into his final term in the program, some peers became critical of his behaviors (as evidenced by Claire’s interview comments), causing his social capital with the cohort to be diminished.

This example emphasizes the contradictions associated with target student behaviors. Although initially successful in his bid to develop social capital from cultural capital, Tony’s social capital did not extend temporally or spatially into other fields. Risk-takers are identified by their willingness to call out questions and answers, and by raising their hands to ask questions and provide answers. Some risk-takers used their interactions to demonstrate their knowledge of chemistry (cultural capital) by answering the professors’ more difficult knowledge questions and asking “thoughtful” questions that gained the respect of their peers and their professors (symbolic capital) for possessing in-depth chemistry knowledge. Observations, interviews, and microscopic analysis of classroom interactions indicate that students and professors recognize risk-takers as possessing significant content knowledge based on their target student practices.

Apart from risk-takers, we identified three other target student categories: networkers, turn sharks, and jokers. Networkers relied on social capital, in this case personal connections with others, to access and appropriate a disproportionate share of the resources. Video analysis indicates networkers often dominated the professor’s attention at the beginning and completion of

classes by initiating and engaging in conversations with professors about topics both related and unrelated to class. Networkers were also observed interacting with their peers and professors through other avenues, such as forming study groups and organizing social functions outside of class.

Erickson (1996) described turn sharks as those who “steal turns” in a teaching/learning interaction. In this study, we observed turn sharks who routinely usurped another teacher’s turn to ask or answer questions, thereby truncating another’s agency. We also observed turn sharks interrupting discussions between professors and other teachers and dominating access to professors and lab equipment. During class, turn sharks often seized opportunities to control conversations by using physical gestures to indicate their wish to speak (e.g., the raising of a hand) or by waiting for a small pause in a colleague’s speech into which they could interject and redirect the discussion, or by simply talking over another person until the first person relinquished his or her turn to speak:

Actor	Happenings	Actions
Prof.:	<i>(cutting in on Kevin)</i> So you see it as part of the inquiry model. I can see where it parallels there. Beth?↑ Did that <u>go on</u> in your group?	
Beth:	Uh huh <i>(Beth nods her head yes)</i> . It did, somewhat. . .(0.5) <i>(nodding and smiling and opening mouth to add more)</i> .	Todd leans forward, raising hand, glancing from professor to Beth and back to professor.
Todd:	<i>(Hand still raised, now looking at Beth, leaning over to look at her to make eye contact)</i> I’ll finish that for ya	Todd makes eye contact with Beth and cuts in on her turn.
Prof.:	Yeah, (0.5) Todd? <i>(General laughter, Beth smiles and looks down while Todd looks ahead and starts to speak.)</i>	Two other male target students laugh. Class laughs.
Todd:	Cause I was going to say something like that because I was in Beth’s group. And. . . <i>(continues his answer)</i> .	

This transcript provides an example of turn-sharking behavior by Todd, a member of the clique identified in cohort 2. Beth provided enough temporal space in her response to the professor’s question that Todd used verbal and nonverbal cues to turn shark and become the responder for their small group to the rest of the class.

Jokers used humor to provide the impression they were involved in learning by interacting with the professor, which could increase their social capital with the professor and their peers. The increase in social capital provided jokers with access to their peers as resources during small-group work. But video analysis of these interactions showed that often jokers did not contribute in a substantive way to discussions, their learning, or that of their peers. Analysis of academic records, observations of classroom interactions, and interviews with program participants (particularly professors) indicate that jokers tended to be somewhat limited, relative to their peers, by their lack of chemistry knowledge.

### The Emergence of Sssh-ers

Another interesting dynamic among our cohort (cohort 1), which I have not seen in the other cohorts was the “shh-ing” phenomena, which at times I found a relief and other times I found unbearable. (Claire, internal evaluation report, fall 2002)

“Shh-ing” was a phenomenon that emerged within and across cohorts as teachers became habituated to each other’s interactions. As evidenced by video analysis, the use of verbal cues such as “shh-ing” by some teachers—usually the target students—limited their peers’ interactions. In particular, risk-takers and turn sharks used this strategy when they judged that teachers with less chemistry knowledge and social capital were either talking off topic or speaking for too long. Analyses of various data sources indicate that teachers who experienced these “shut-down” behaviors possessed less cultural and social capital than the teachers who “shh-ed” them. These behaviors support our claim of participants competing, often perhaps unconsciously, for resources specific to the field and served to optimize the resources for target students, as professors may have seen these interactions as supporting the need to “move on” and not become “bogged down” in off-topic conversations (Tobin, 2005). Over time, the target students became more overt in their verbal disapprovals by stating that the remarks from peers identified as having low capital were unnecessary and time consuming. In some instances, questions asked by certain teachers during whole-class discussion that were deemed inappropriate by their peers were scathingly rebuked and silenced by overt forms of shh-ing:

You should have been here earlier today. Some students’ questions about nomenclature got too way out. People were asking too many “what if”-type questions and, you know, Dr. Johnson is so nice he is not going to tell anyone to shut up, so he answered them all until lots of under rumblings redirected the discussion. Eventually Markita [a student] told people that if they wanted to read a paper on this or something they could go right ahead, but that we need to keep on moving. (Martin, field notes, cohort 4, 7/23/03)

Markita’s “shut down” was directed toward a low-achieving teacher in both the chemistry and education courses. Target students often complained about perceived digressions by professors from the intended curriculum that served to, as Markita said, “catch these [teachers] up.” The contradiction in this example is that Markita had low cultural capital and, after the first fall semester, was asked to leave the chemistry course due to her inability to maintain the required minimum grade average. However, Markita’s strength as a target student came from her role as a networker. She socialized exclusively with high-achieving teachers, serving as a contradiction to other patterns of teacher interaction within the class where teachers homogeneously grouped by level of content knowledge. By socializing with high-achieving teachers, Markita gained symbolic capital among her peers, enabling her to “network” by maintaining relationships with peers that could benefit her studies. Her participation in this redirection of a class conversation gained her more symbolic capital with her high-achieving peers by enacting shut-down practices that kept class moving at a certain pace. The following observation concerned a particularly resourceful networker from cohort 1 who was widely recognized by her peers, program instructors, and administrators for her use of “shut-down” strategies:

Tamika was particularly admired and feared for her unabashed method of shutting down students (and even professors at times!) for what she viewed as unnecessary meanderings from class. Over time I began to feel uncomfortable with how violent some of these encounters were—she really disrespected people sometimes, but no one ever spoke up in anyone else’s defense. I think they were afraid she would turn her attention to them. I know I was. (Martin, cohort 1 member, interview, spring 2001)

In her cohort interaction, Tamika was forthright about her desire to access the resources she perceived as necessary for her success in the program. She was not characterized by others as a

“team player” and would only participate in group activities to increase her chemistry knowledge. She networked to access resources she could not obtain through other strategies. For Tamika, and teachers like her, enacting shut-down tactics were effective practices for garnering access to resources for a myriad of reasons. For teachers who have little cultural capital to contribute to class or group work, becoming known as someone who will speak his/her mind, act as a vocal monitor of unwanted classroom behaviors, and serve as a delegate for the class to negotiate assignments with professors allowed these teachers to garner symbolic capital. Through their social networking, these teachers knew that the majority of their cohort did not value the practices of some peers or professors. Although these risk-taking networkers may have unconsciously enacted these shut-down practices, they still gained social and symbolic capital with their peers and professors, as evidenced by video analysis of classroom interactions in which some students and professors indicated their approval of these practices through their laughter and head-nodding. That neither the professors nor their peers acted to stop such behaviors communicated to all students an implicit acceptance of these types of behaviors. Capital earned from these interactions could be exchanged for access to resources in the form of cultural capital as networkers gained admittance to peer groups composed of high-achieving students who benefited from these shut-down strategies in class. In this way, networkers could use their symbolic capital and could “take charge of whole-class interactions” to build social networks with teachers with high cultural capital, thus providing the networker with access to resources that supported her/his efforts to learn chemistry. However, this was a high-risk strategy as observations, interviews, and anonymous survey results indicate that networkers also offended some peers and professors, which resulted in a loss of social capital. Thus, networkers had to negotiate a fine line between seeking support and becoming excluded.

Teachers were not the only ones who attempted to control whole-class interactions through overt means. One chemistry professor was particularly well known for enacting shut-down strategies:

I enjoyed Dr. Fritz’s class in particular because he stopped students from showing off in class. When certain students tried to prove they knew chemistry by adding unnecessary information in their answers and questions, he would ask them a difficult question they could not answer to indicate to that student and the rest of the class that they did not, in fact, know everything! (Martin, cohort 1 member, interview, spring 2001)

This interaction served two major purposes; Dr. Fritz established equity in the classroom by preventing potential target students from accessing more resources than other learners. Concurrently, these shut downs illustrated the professor’s power in managing the classroom interactions and reinforced the depth and extent of his own cultural capital. Consequently, target student behaviors were generally less prevalent in Dr. Fritz’s classes, compared to other courses in the program. Dr. Fritz’s behavioral management techniques, although effective, did not extend agency to his students. However, as noted in the following sections, his attempts to regulate teachers’ interactions informed the actions of the chemistry education professor in the subsequent academic year as he attempted to adhere to the authenticity criteria of the evaluation. Thus, the research informed us of a need for change and catalyzed changes that afforded the agency of all program participants. In the following sections, we describe how the theoretical and methodological framework of our research enabled us to identify classroom structures that afforded target student practices and clique formations and the catalytic action taken to resolve these issues.

### Changing Fields and Changing Capital

Target students' use of practices (such as hand-raising and calling-out), across time and in different class settings, supports the belief that practices are both culturally and historically situated and are constructed throughout a learner's career (Tobin & Gallagher, 1987). However, culture and cultural practices have fluid boundaries and thin coherence, thus observation of target students' cultural patterns will also produce examples of contradictory cultural patterns (Sewell, 1992, 1999). For example, a teacher who is a target student in one class setting may not enact target student strategies in a different setting because of changes in her capital. These contradictions provide important data for understanding culture and for initiating changes in structure and associated practices.

A teacher's ability to act as a target student is determined by which types of capital are important in the field and how much capital she possesses. A change in field, such as when teachers move from one discipline to another (such as chemistry to education), might have an impact on target student status. A teacher who enacted target student strategies in the chemistry courses might continue to be a target student in the education courses even if she has less teaching experience than her peers. Thus, teachers with little education knowledge and experience transferred their forms of capital from chemistry to education, but this was only possible with the collusion of peers and due to the porous boundaries of fields that can enable participants to transfer cultural practices from one field to another.

Alternatively, this change in field also allowed new target students, who were not central participants in the chemistry courses, to emerge in the education courses. For example, we observed that some veteran teachers who had the ability to relate chemistry and education in their teaching practice garnered cultural and social capital by recounting these experiences. However, many of these anecdotal stories of classroom teaching, while informative, did not appear to increase their level of symbolic capital compared with solving difficult chemistry problems or performing well on exams and lab reports. This was most notable with experienced teachers who had little cultural capital associated with knowing chemistry.

Changes in activities, such as going from a whole-class to small-group setting, or from the lab to the library, also had implications for a teacher's agency. Some teachers who rarely interacted in a whole-class discussion showed confidence in small groups and productively used their social capital. At other times, target students in large-group settings were less notable in small groups or in the laboratory. A possible explanation for these observed changes was that teachers accumulated less cultural and symbolic capital in small groups, especially when group work was not evaluated for a course grade. In whole-class interactions, target student behaviors, such as taking risks to ask and answer questions, shh-ing, and turn sharking, provided teachers greater access to the classroom's limited resources. This in turn provided greater teacher agency and the power to act and change structures within the field, such as becoming the focus of the professor's attention or directing the lesson's overall focus and/or the cadence of specific lessons.

Our analysis of teacher interactions across fields, both in the education courses and chemistry courses, indicated that roles gained in one field were maintained in another, so both target students and teachers who were victims of shh-ing or eye-rolling in their initial summer chemistry classes maintained their positions in the fall/spring education classes. One might assume that more experienced teachers would have a more authoritative role in the education classes, but this was not supported by the evidence from video vignettes, observations, interviews, and field notes. Thus, reinforcing our argument that chemistry knowledge garnered the most cultural capital among program participants. Teachers who gained social and cultural capital in chemistry courses by "knowing chemistry" often maintained their status in the education courses and teachers who lacked cultural capital in chemistry remained marginalized in the education courses.

### *Maintaining Peer Group Status and Cliques*

From micro analyses of videotape, we noted that the cohort 2 clique used nonverbal gestures such as eye-rolling, arching of eyebrows, repositioning of their bodies and/or gaze, folding of arms, and/or rocking back and forth in their chairs to take attention away from other teachers. We identified this as disrespecting their peers because these nonverbal disapproval methods could be shared with a wider audience without necessarily including the person or persons at whom the behavior was directed, thus building social networks and providing a sense of solidarity within a select group of teachers while purposefully excluding others (Collins, 2004).

### *Brow-Raising and Eye-Rolling, Dismissed, and Disrespected*

Although similar behaviors such as shh-ing and eye-rolling had been observed in cohort 1, these practices were more overt in cohort 2. Examination of field notes and analyses of videotape of cohort 2 classes from the commencement of their program involvement revealed emerging patterns of teacher preference for particular seating arrangements and choice of partners for group work within the first weeks of the program. By the fall term, some teachers had already experienced a level of isolation that affected their agency. The following is an excerpt from an interview with a teacher recounting her sense of exclusion from the cohort's clique members and how this affected whom she would approach for help:

I remember one day a bunch of them [clique members] did something together—they had some kind of party and I did not know about it but I heard them planning it. At first I felt left out, but I talked to my husband and he said, “You’re a grown woman with children, why do you care what these people are doing?” I felt pretty silly then, but maybe someone else in class did not feel good about it. They are social things [parties], but it does affect to whom you can go to for resources [based on social ties]. Some people were not very helpful who could have been. (Monica, cohort 2 member, interview, summer 2003)

In different social situations people might experience a sense of isolation, whether or not it is warranted. However, the clique in cohort 2 developed during the first year and became prominent in the second year of this study. The clique comprised three men, all with undergraduate degrees in chemistry who taught in exclusive high schools, and two young females, both non-chemistry science majors who were not currently teaching. One woman was a doctoral candidate and the other was a full-time graduate student. The teachers in the clique were among the youngest in their cohort, ranging from 20 to 32 years. The group occupied the desks toward the back of the room, leaving several rows of empty chairs between themselves and their peers. Labeled by both their peers and professors as a “powerhouse of chemistry knowledge,” this group (especially the male members) enjoyed high cultural, social, and symbolic capital. Professors, peers, and researchers identified the clique's male members as target students and called them “the Lads.” We named the clique, Powerhouse.

Data analysis revealed multiple instances when Powerhouse's members engaged in disruptive and dismissive behaviors, such as talking and eye-rolling, when other teachers or groups participated in whole-class interactions. The following video transcript illustrates how target students and clique members marginalized and disrespected other teachers. In this vignette, teachers had organized into four peer groups to answer questions about x-rays and energy. One group of five students was positioned to the left near the front of the room with two other groups of four paired to their right in the front and middle of the room. The target student group was positioned at the back of the room behind all of the other groups:

Actor	Happenings	Actions
Marnie:	Uhm . . . part of the disagreement is sometimes just how much radiation therapy, including chemotherapy therapy [is needed], and what ↑ exactly are you doing to the bad cells? Hopefully you are not worsening the situation (1.0) and while we are at it, [what are we doing to the good cells as well?	Female members, Beth and Lisa, of the target clique lean toward one another. Beth is positioned inward towards her group members and away from the front and the presenting groups.
Prof.:	= Uhm huh ( <i>All students looking forward, except Lisa who continues to look at Beth while Beth continues to look forward</i> ).	Lisa is smiling, one eyebrow raised, trying to get the attention of Beth.
Marnie:	What you are [doing], is mutating them as well [and	One male group member, Kevin, is looking out the door of the classroom.
Bob:	=You're actually taking [poison]. . .	Lisa continues to smile and face Beth. Kevin continues to look out the door.
Marnie:	= <u>yeah</u> , how much damage are you doing versus, what [is good for you]? [you	
Bob:	= Trust me. ( <i>cutting in</i> ) Trust me, it's no fun [indicating he has recently gone through radiation therapy for his own cancer].	All three male clique members look at one another and begin to lean inward towards one another. All other students in the classroom remain attentive, facing speakers, nodding agreement, etc., during entire exchange.

As the conversation continued, a third group member offered an anecdotal account of a nurse who, in the 1950s, suffered numerous miscarriages because she was exposed to x-rays through her work. Based on grades, observations, and interviews with peers and professors, this teacher was identified as having low cultural capital (chemistry knowledge). However, video analyses indicated that he routinely used joking strategies to garner social capital with the cohort and his professors. As one of the jokers, Andy's one-liners and anecdotal stories provided him a participatory role in whole-class interactions:

Actor	Happenings	Actions
Andy:	I mentioned that I know a women who had miscarriages from holding babies in the emergency room while she was pregnant 50 years ago, before they knew, then they figured out that. . . ( <i>Sam looks quickly in the direction of Todd with a furrowed brow and Todd looks quizzical, small head bob as Sam looks hard at the back of Andy</i> ).	Two male clique members raise their eyebrows and furrow their brows. All clique members are smiling about this exchange.
Class:	[ <u>What?!</u> ] ( <i>very loud exclamations from around the room</i> ).	Students from all around the room turn to face the presenting group.
Andy:	( <i>trying to explain</i> ) She was holding babies in the emergency room, for x-rays	
Prof:	=for x-rays.	
Class:	Ohhhh! (hh)	Clique members laugh, roll their eyes, and shake their heads.
Andy:	= Yeah, 50 years ago there were all these radioactive babies.	Beth bangs head on the table while Sam and Lisa laugh. Kevin puts hand to head and shakes his head laughing.

The above vignettes provide examples of target student and clique behaviors that disrespected teachers with less social, symbolic, and cultural capital. Even while Andy's offering was

constructed to invite some peer laughter, the exaggerated responses from the clique members established classroom structures that served to isolate some teachers from collective interactions that could have assisted these teachers to build capital. Behaviors such as eye-rolling, talking while peers were sharing, laughing when others presented ideas, and head-shaking were all mechanisms by which teachers who knew chemistry were able to subjugate peers to less favored roles as those who did not know chemistry. Marnie, Bob, and Andy provided relevant contributions to the classroom discussion, yet Powerhouse's members demonstrated their disrespect through blatant actions such as raising eyebrows, eye-rolling, and exasperated looks, which signaled to the teachers with less capital that their knowledge was not valued or appreciated. These behaviors allowed clique members the opportunity to build social capital with one another within their group and with other teachers and professors while simultaneously reinforcing their exclusivity.

### Influences on Clique Formation in the MSCE

How did this clique develop? This question troubled us as we examined classroom interactions. We propose that MSCE's structure and its sequence of chemistry courses may have created an environment that fostered the clique's development. The program began with two chemistry content courses during the summer followed by a chemistry course and an education course scheduled during the academic year (see Fig. 1). This schedule structure emphasized the importance of attaining chemistry content knowledge and led us to speculate that MSCE's science discipline focus privileged the knowing of chemistry above pedagogical knowledge and, as such, maintained structures that supported target student status across fields. The number of courses allocated to each discipline served to reinforce the importance of chemistry (8 courses) over the importance of education (2 courses) in the program. We believe the way in which the program's courses were scheduled was critical in structuring participant understanding of what knowledge (chemistry content) was most valued and that this recognition is salient to understanding how specific teachers constructed their way of being in the program, specifically in terms identifying and forming peer groups.

In the program's first summer, the chemistry professor established small groups to encourage cooperative and collaborative learning. After an initial period, he regularly rearranged groups to ensure that cohort members had an opportunity to interact across ability groups. However, professors teaching the chemistry courses after the first summer allowed teachers to self-select groups based on established social networks:

I chose to work with people who were most like me and who were most willing to help me. I did not feel I had as much in common with some of the older teachers who are married or have children already, so I began to hang out with the guys [the Lads] and Lisa because we all have so much more in common. (Beth, cohort 2 member, interview, spring 2003)

Initially, teachers used chemistry content knowledge, age, race, school placement, and/or gender as organizing schema for establishing their peer groups and, over time, these groups established strong borders. Other teachers recognized the group to which Beth refers to in the above transcript as a separate entity, a clique.

In addition to professor-directed and peer-initiated group formation, the course schedules provided a second structural construct, which may have shaped teacher interaction patterns. In the summer, teachers met daily for 8 consecutive weeks, but in the academic year they only met twice

a month. The lack of social contact and communication with peers outside of class may have provided further impetus for clique formation. For teachers who lacked cultural capital, the formation of strong social bonds and networks was imperative to ensure continued access to peers as resources during the fall/spring courses. When questioned about this possibility in participant interviews, several teachers agreed:

There is a strong social aspect to classes in the summer that I do not find in the fall/spring courses. In the summer, we have greater contact with one another and in the year-long courses we are more isolated because no one wants to hang around after class on a Saturday. So unless you have an understanding of the material covered in class, or you have someone to help you outside of MSCE, you really struggle to keep up. (Claire, cohort 1 member, interview, fall 2002)

During the summer courses, teachers congregated before and after class in both social and work-related settings discussing assignments, concepts, and problems. After Saturday classes, both teachers and professors dispersed quickly, leaving teachers heavily reliant on previously formed peer groups for support. Teachers in some peer groups arranged to meet outside of class and communicated by phone or e-mail to collaborate on assignments. This issue of having access to others as resources became particularly important for teachers who struggled with the content. The program administrators recognized this need and implemented Saturday afternoon tutoring sessions in mathematics. However, some teachers viewed these sessions as another way that programmatic structures undermined their tenuous cultural capital. These teachers lacked social and symbolic capital, were isolated from their peers, and were unable to find successful strategies to generate chemistry knowledge. In evaluation documents, teachers in cohort 4 commented on these issues:

It seems as though members who don't teach chemistry have a more difficult time [learning the material]. I try to help if I can, but due to time restraints and the speed of this course, time isn't always available to spend working with someone. I hope no one sees this as being left out, but it may be received this way. (cohort 4 member, anonymous survey response, summer 2003)

There is very little incentive for people to work together unless people feel like there is a degree of exchange occurring. For me, I get annoyed when people ask me how to do things and mooch. I'm always helping and not getting any in return. It is one thing to struggle and then ask [for help], but some don't, and it makes us not want to help them at all. (cohort 4 member, anonymous survey response, summer 2003)

These comments indicate recognition of tensions that existed for teachers between learning chemistry and being supportive of their peers. This was a concern because a goal of the program included improving teacher practices by encouraging the development of supportive collaborative networks. It appears that, while espousing specific educational goals, the program actually rewarded performance in only one of the program goals: improving content knowledge. As we have indicated earlier, much of this modeling was unconscious, but it has implications for structuring content-driven professional education programs. Fortunately, the design of the program and the program's evaluation process enabled us to not only identify these issues, but to alter structures to effect positive change. The following sections provide an account of some of the issues we encountered with regard to cliques, which led to our decision to address these issues in an attempt to improve the learning environment in the program.

### Professor and Student Interactions With Cliques

Our analysis revealed a hierarchical structure for cliques consisting of leaders, followers, and wannabes. Clique leaders emerge by either asserting their superiority over others in their peer group or by indebteding others with loyalty to themselves by offering either material or social help (Adler & Adler, 1998). One female member of Powerhouse noted that her inclusion, and that of the other female member, were initially established through social networking:

I think we first became friends because the guys [the Lads] were always so helpful in and out of class. If Lisa or I did not understand something, one of them would explain it in a way that we could. We just became friends because they helped me so we always sat together. (Beth, cohort 2 member, interview, spring 2003)

The establishment of Powerhouse became apparent during the second summer when clique members refused to join other groups or allow others to join their group. Other cohort teachers stopped attempting to join Powerhouse for small-group work, joking that they were a “gang.” During a member-checking interview, Beth presented an alternative rationale for the formation of the clique to which she was identified as a member:

I never felt like I belonged to a clique. My background in chemistry was not very strong so I relied on a few others who had a better understanding of the material to help me. They were always nice and explained things for me. I still talked to and associated with other students outside the classroom, but in class we all pretty much sat with whomever we could best work. (Beth, cohort 2 member, interview, spring 2003)

The comments of Beth and of her peers indicate that Powerhouse’s exclusionary practices were a combination of conscious and unconscious behaviors by clique members. Adler and Adler (1998) identified a number of practices designed to maintain clique membership and to establish distinct territorial lines between themselves and others. Apart from physically locating themselves behind and away from the rest of the class, Powerhouse established their boundaries through the use of eye-rolling, laughter, chair-shifting, and derisive smiles. These behaviors served to reinforce the message that they did not wish to, nor did they see the need to, engage with other members of the class. This did not, however, prevent other teachers from seeking membership into this elite clique by using the clique’s exclusionary behaviors. Using a term proposed by Adler and Adler (1998), we called these teachers “wannabes.”

#### *Wannabes*

Wannabes exist on the periphery of a clique, participating in some activities but predominately subjected to exclusion and rejection. Angel emerged as a wannabe. She had adequate chemistry knowledge (as evidenced by her grades and her performance in class), but lacked social capital, especially with Powerhouse. Microscopic analysis of numerous videos from class indicate that Angel attempted to join Powerhouse on several occasions by laughing when clique members derided other teachers, by glancing backwards to try to catch eye gazes of clique members when teachers with low capital were talking, by participating in eye-rolling behaviors, and by praising the intelligence of Powerhouse’s male members. Asked to self-analyze her actions in video taken from an Inorganic lab during a member-checking session with cohort 2, Angel explained how difficult it was for her to be “caught in-between” her professor and the male Powerhouse members. In the following vignette, Angel recalls her dilemma when the three target

males questioned, based on the color of her solution, what her chemistry professor had told her to be the endpoint of a titration lab:

It was always the three guys across from me [in lab] and they were always asking me, “Is this purple enough? Is this the right color?”...And I had already asked Dr. Fritz [the professor], and he said, “That’s right.” And you guys were like, “Is this right?” And I said, “That is what he [Dr. Fritz] told me, so it must be right!” It was very funny being caught between them. (Angel, cohort 2, member checking video session, fall 2002).

Angel felt that she had to choose between the Lads and the professor in order to determine whether her titration was complete. She indicated she felt torn between the professor’s knowledge and the assertions made by the Lads, demonstrating that she privileged the cultural, social, and symbolic capital of these three clique members over the professor’s chemistry knowledge.

Angel was not the only wannabe. Several women attempted to increase their social capital with the class and the male clique members in particular through nurturing behaviors such as bringing fresh baked goods to each class. Although in other cohorts both men and women brought food to class, in cohort 2, class members with low cultural and symbolic capital provided this service. While serving to reinforce gender stereotypes, video analysis and observations indicate that these nurturing practices did not provide the women with membership privileges to the clique, such as inclusion in the seating arrangements, collaborative work efforts, and/or extensive socializing. Outside of the formal classroom setting, some cohort members with varying amounts of capital would interact with clique members. We observed that most of these interactions were with veteran teachers who possessed cultural capital related to teaching. These interactions, however, were not all-inclusive as the members of the presenting group (Marnie, Bob, and Andy) from the earlier vignette were hardly ever seen interacting socially with any clique members.

### *Professors and Cliques*

Being perceived by professors as members of an elite group can be beneficial to clique members because the associated power and status may provide such members with more access to the professor who serves as a resource for their learning. An example of this was noted through both field notes and video analysis when one of the chemistry professors provided the male members of Powerhouse with a more challenging problem set than the rest of their cohort peers. When Angel attempted to join their group, both the professor and the Lads denied her access to the group by deflecting her request saying she should “help her own group.” When asked about this incident, Angel indicated she was angry with the professor for embarrassing her by suggesting in front of her peers that she “would not be able to handle the problems.” Also, although some professors enjoyed an easy camaraderie with certain target students and clique members, video analysis showed this was not always the case as, on occasion, some target students disrespected professors by talking during lectures and instructional presentations. Additionally, several target students gained enough cultural and social capital within the classroom that they risked undermining the status of their professors in more overt ways. The following field notes and accompanying video vignette transcript illustrates this issue:

A new MSCE faculty member who had little or no previous contact with the program participants was teaching his first class. After a brief introduction to his course, he asked the teachers to break into three small groups, of their own choice, to discuss some concepts related to light and some properties of light. Teachers were given about 20 minutes and

were then asked to report their findings back to the class. Approximately 2 minutes after the first group of teachers (all female) started to speak, the Powerhouse clique began talking to each other. These teachers were turned inward away from the rest of the class and carried on a lively conversation, smiling and laughing while the first group presented. The professor looked in the direction of the Powerhouse group several times during this exchange to gain their attention, but they ignored him. (Martin, field notes, cohort 2, September 2002)

This event occurred in the first class meeting of the second fall session and illustrates not only Powerhouse's disrespect and disregard for the women who were presenting (indicating by their behavior they did not value these women's contributions), but also for the authority of the new professor who was conducting the class activity. However, when Powerhouse presented, their body language and verbal interactions with one another and the professor sent the message to everyone that their contribution was important and was, in fact, superior to the presentations of the two previous groups:

Actor	Happenings	Actions
Todd:	Okay, ( <i>lowering hand while pointing at comments written on the board by the professor from the previous group</i> ), we already discussed a lot of what is already up there so, I won't repeat, uhm. ( <i>Group members are looking at one another and smiling. Sam snorts out loud laughing into his hand, leans back smiling at the two women in his group</i> ).	Powerhouse members openly laughing.
Todd:	But, we talked about the energy ( <i>leaning farther back in his chair and gestures in the air with his hand</i> ).	
Prof:	= Is that a tradition? Saying, "we said that. Ditto."	
Todd:	Yeah, it really is ( <i>laughs and shrugging shoulders and raising eyebrows</i> ). (hh)	Wannabe student Ashley laughs and rolls her eyes at own group members.

Following this transaction, the professor indicated that the group should continue to share their findings. The Lads sat in the back of the room in a row, with the two female members seated in the next row with their desks turned toward the Lads and away from the professor and their classmates:

Actor	Happenings	Actions
Todd:	The only thing we said is the difference in energy is because of, the frequency of the [wavelength	
Prof:	= Uhm, uh-huh.	
Todd:	= We talked about $E = hv$	
Prof:	( <i>Writing on board</i> ) Good. [I don't remember mentioning that... ( <i>The Professor is visibly pleased with Todd's answer, smiling and writing on the board</i> ).	Todd looks at Sam and they exchange a smile. Sam points to an equation he has written on his paper for Todd to relate out.

Todd:       = or $h = c/l$ . And no, no you didn't [mention that].	Todd is smiling and looking at the professor, whole clique is smiling and looking from Todd to the professor and back. Students in other groups are seen looking at one another and smiling. Some smile with arched brow and head nods.
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This teacher–professor interaction was very important for several reasons. First, this was Todd's initial verbal interaction with the professor in the presence of his peers. Microanalysis of Todd's and the other Powerhouse males' body language indicated an attitude of ease with the material. Two of the male members, including the presenter, were seated with their hands folded across their chests while leaning far back in their chairs so they were nearly prostrate in their desks. This “first appearances” interaction with the professor set the stage for future interactions while concurrently demonstrating to the professor and their peers that this activity was trivial. By laughing and talking while the first group presented and then continuing to laugh when referencing the previous groups' attempts, they devalued the contributions of their peers. That no teacher in the class spoke while Todd presented suggests that he had significant social and cultural capital. In addition, microanalysis of video indicates that Angel, a wannabe teacher, attempted twice to join Powerhouse through eye-rolling and by trying to engage the gaze of clique members. Laughter from both classmates and his professor suggested Todd gained social and symbolic capital. The activity, as assigned, requested that teachers provide conceptual ideas about the properties of light, but Todd used mathematical equations to establish the relationship between light and energy, reinforcing his and his clique's superior chemistry knowledge. The professor's pitch inflection upon hearing these equations indicated he was impressed with Todd's content knowledge because he had not asked for or possibly even anticipated that teachers would know the quantitative expressions. In this case, Todd garnered symbolic and social capital with the professor, reinforcing his leadership role in the clique and the cohort even while dismissing the activity as trivial.

### Dissolving Cliques and Quieting Target Students

In what follows, we revisit the turn-sharking vignette first presented in the beginning of this study to provide a snapshot of interclique interactions in relation to gender. In addition, we include the response of the chemistry education professor to this turn-sharking behavior as an introduction to some of the breaching strategies used to curb these target student and clique behaviors. The vignette begins with Dr. Kenneth Tobin, the professor, acknowledging two Powerhouse members who wished to speak: one female and one male. When Kevin speaks, the clique leader, Todd sits with his arms folded across his chest. In the following transcription, Ken specifically addresses the female clique member by cutting short the contribution of Kevin, and encouraging Beth to contribute:

Actor	Happenings	Actions
Ken:	<i>(cutting in on Kevin)</i> So you see it as part of the inquiry model. I can see where it parallels there. Beth?↑ Did that <u>go on</u> in your group?	
Beth:	Uh huh <i>(Beth nods her head yes)</i> . It did, somewhat. . . (0.5) <i>(nodding and smiling and opening mouth to add more)</i> .	Todd leans forward, raising hand, glancing from Ken to Beth and back.

- Todd: (*Hand still raised, now looking at Beth, leaning over to look at her to make eye contact*) I'll finish that for ya (*Sam looks at Todd and Kevin jerks head in Todd's direction*).
- Ken: Yeah, (0.5) Todd? (*General laughter; Beth smiles and looks down while Todd looks ahead and starts to speak*.)
- Todd: Cause I was going to say something like that because I was in Beth's group. And it was really good that in our group we all come from different backgrounds of teaching and (2.0) things that we threw out (*makes small throwing hands*) there that we could not do in the whole classroom (*elongates arm movement to emphasize larger group instead of small group discussion*) that we were able to do in a small group and kinda see other points of view and how we interpreted different things in the articles and actually we were kinda explaining each others opinions for a while and pointing arguments out there and hashing them out there, you know which we couldn't do in a larger group, so it really worked in that sense.
- Ken: (*Camera begins to pan back toward the front of the class*.) Right, so in Texas back in the mid-eighties it was mandated . . .

The transcription reveals an important pattern characteristic of target students, monopolizing speaking time. Todd spoke continuously for nearly 30 seconds, allowing Beth only 2 seconds to respond to the question Ken posed directly to her. This behavior not only enabled turn sharks to “steal” another’s opportunity to speak, but such monologues greatly reduced the amount of time other teachers had to contribute in any one question–response interaction. Video analysis indicates that long-winded contributions, once finished, often signaled the end of the topic discussion because the professor needed to move to the next activity.

This vignette also illustrates the gendered nature of learning environments, especially in subject areas where male students are perceived as more competent than female students (Rich, 1979; Scantlebury, 2005). Studies document that men routinely interrupt women speaking and women concede their right to contribute to the discourse (Tannen, 1991; Thomas, 1990). This turn-sharking episode occurred when the male clique leader attempted to make eye contact with his female clique member who was speaking. When he failed to accomplish his task covertly, he interrupted by saying he will “finish that [the explanation]” for her. The laughter of the class and the teacher who was turn-sharked suggests that, although this move was bold, it was expected behavior from Todd.

This example suggests that the privileging of chemistry knowledge in the program allowed a target student from the chemistry courses to negotiate the porous boundaries between the fields of education and chemistry. Todd, the turn shark, recently completed an undergraduate degree in chemistry and had distinguished himself as a top chemistry student among his peers and was recognized as such by past chemistry professors. Beth was a PhD candidate in science education and participated in the MSCE program as a second program. Although her chemistry knowledge was limited relevant to Todd (as evidence by her transcripts and entrance interview), she had recently discussed the paper Ken was referencing in her doctoral studies class. However, gender schema provided Todd the structures to turn-shark Beth even when she was clearly more expert in this field.

By abruptly changing the subject of discussion and without extending any congratulatory remark for his response, Ken used two breaching strategies (Tobin, 2005) to effectively shut down Todd. Todd garnered no social or cultural capital from the professor in this exchange, unlike in his exchange with the chemistry professor introduced in the previous section. This example provides professors with strategies they can use to curtail the behaviors of target students to ensure more equitable access to resources for all learners. In the following section we examine some other breaching strategies developed by Ken in conjunction with Kathryn (both of whom taught the forthcoming education courses), which were specifically and consciously directed toward achieving more equitable peer interactions by making teachers aware of their classroom practices and by dismantling Powerhouse.

### Instruction and Action

During cohort 2's second summer session, Ken and Kathryn observed cohort members in formal and informal settings. Through these observations, discussions with teacher-participants and professors, and analysis of video from previous course sessions, they identified several target students who dominated class discourse and prevented others from participating in meaningful ways. Their findings contradicted the programmatic claims that all learners were valued and that the contributions of all students needed to be equally expressed and considered. In addition, they noted that teachers and professors sometimes ignored or devalued contributions from participants we identified as lacking cultural capital in the form of chemistry knowledge. Ken and Kathryn proposed to alter classroom structures so that disenfranchised teachers had greater access to resources by implementing what Ken called "breaching strategies." They reasoned these changes would engender a more inclusive learning environment for these teachers.

### *Breaching Strategies*

Ken and Kathryn employed five deliberate breaching strategies to ameliorate the negative impact Powerhouse had on the classroom environment. First, in informal settings, they talked with the disrespected teachers to propose different pedagogical approaches for changing the classroom culture. Ken and Kathryn used these encounters to assure the teachers that they were aware of their peer's disrespectful behavior and that they intended to take action to change the classroom climate without further jeopardizing these teachers' social status among their cohort peers. Second, they planned changes in class structure such as assigning teachers to groups of three in order to break cliques and to rearrange peer groups. Third, for each class session, they developed three or four activities revolving around these preassigned groups that exposed teachers to new partners while permanently breaking previously formed peer groups.

In this way, Ken and Kathryn moved from using whole-class discussions and an open forum format to relying exclusively on small-group discussions where the instructor selected the teachers who reported back to the group and where participants were assigned specific group roles on a rotating basis. Thus, in one activity a teacher would be expected to record group information and in the next activity, in a different group, she would be the group reporter. Each teacher held each role at least once during the class session.

Fourth, Ken and Kathryn used a random number generator to select the groups and they explicitly informed the teachers of this strategy as a useful tool that they might use in their own teaching. However, although the groups were randomly selected, the roles assigned to group members were strategically designed with the purpose of disrupting established power and gender dynamics. For example, previously identified male clique leaders were assigned the role of

recorder rather than reporter when placed in a small group with two females with low cultural and symbolic capital. This arrangement provided a structure in which these females had increased agency to speak and to publicly represent their groups' findings. Ken and Kathryn supported the restructuring of cohort interactions by circulating around the room during small-group activities, encouraging teachers to fully engage in their newly assigned roles and modeling a positive pedagogical strategy that extended the role of the instructor to small-group facilitator.

Finally, Ken and Kathryn presented their concerns to cohort 2 in a whole-class discussion in which they stated that they had observed disrespectful behavior that was detrimental to the learning environment and that the new teaching approaches just described were being introduced as structural strategies to explicitly counteract these behaviors. In the following vignette, Ken explains to the class why he is assigning new peer groups while two male target students from Powerhouse engage in an exchange about the proposed changes to the structure of the class:

Actor	Happenings	Actions
Ken:	I got up very early this morning and one of the things I got up to do was to arrange the groups. And the groups were put together as a structure. It is a structure that I put on the event because from my point of view, from having looked at the tapes [of the cohort members in classes] for a long time now, there are certain group arrangements that probably wouldn't work so well. And as teachers, you must do that too, right? So, there are some structures, that you put on [classes].	All clique members face forward and listen to Ken attentively. Sam elbows Todd to look at his notes.
Sam:	<i>(Elbowing Todd for his attention and beginning to write on his notebook what he wants to say, then he decides to whisper to Todd.)</i> [I think we have been separated.	Todd nods yes.
Ken:	= and the way you arrange people would be one example of that. What's another?	Students are all facing forward again.

Although several students did not want new groups, Ken explained that target student behaviors in the class and within the cohort had negatively impacted other cohort members. He intended to alter the structure of the classroom to change this situation and also expose the teachers to different people with differing learning and teaching styles. The following is a transcription of Ken explaining why he had placed teachers in groups of four in the first activity of the newly formed groups and why he would be continuing to change these pairings and what he hoped to accomplish by doing so:

So what do you think of the groups? I will answer that. I think they were pretty evenly spread around, but there were some people who dominated in those groups. And so guess what? Next time I put you in groups, it will be in groups of three. The reason it will be in groups of three is it will change the social dynamics in the groups. And the reason we will change the social dynamics in groups is for equity reasons. We do not want to have established patterns of power relationships that are oppressive to the same people all the time, because it is not fair. It is an equity issue. (Ken, lecture, November 2002)

Ken clearly outlined his expectations for class dynamics and his reasons for changing the classroom structure. In the following video transcript, Ken evokes an activity aimed at stopping

Powerhouse members from talking while a teacher, who was often a target of ridicule, responded to a question:

Actor	Happenings	Actions
Marnie:	So, in my classroom. . .	Powerhouse members all start talking.
Ken:	<i>(Ken interrupts Marnie, holding up his hand.)</i> Okay stop a minute. I am making an assumption here that we are listening to Marnie <i>(motioning to Marnie)</i> . Marnie stand up, they can't hear you. Do you mind?	Powerhouse members stop talking, and face forward.
Marnie:	<i>(Marnie finishes her sentence with all students facing forwarding, attentive.)</i>	Everyone looks attentively in Marnie's direction.
Ken:	Okay, thanks. The reason I got Marnie to stand up is because she is sitting at the front and her voice is low and as soon as she started to talk there was inattentiveness. And so my assumption is that we are all listening and learning and that was not so because she was too far in the front. And you have that happening in your own classrooms, right?	Powerhouse members continue to face forward, not speaking.

Ken breached clique behavior in this instance by drawing public notice to their conversation. Although Ken did not address Powerhouse members by name, he both motioned and held his gaze in the direction of clique members while speaking, indicating to other class members seated in front of this group that they had been talking while another class member was speaking. Ken's forward treatment of their behavior was not presented as a challenge that served to alienate these teachers from him or the rest of the class because they were not publicly chastised. When Ken made obvious the inappropriate behaviors in his classroom, he always made reference to how teachers would handle such situations in their own classrooms. As in the above vignette, he asked the teachers to compare their behaviors and the behaviors of their peers to the actions and behaviors of students in their own classrooms. The teachers began to examine what types of student–student interactions they allowed to occur in their classes and how these interactions may be affecting the learning of their students. One might assert that Ken was merely enacting good teaching practices, but when his methods were discussed with chemistry professors, they argued that their role was to “teach chemistry, not to control student behavior.” However, as we have demonstrated in this study, this perspective was at best narrow and at worst detrimental to the learning of some students in the program.

Another method Ken introduced that forced teachers to begin to examine their behaviors in his classroom was to show video clips of various teacher–teacher and teacher–professor interactions from their previous courses. Ken introduced this activity by explaining how useful video can be for both teachers and students when researching the culture of classroom practices. Ken explained that evaluation of the MSCE program used video analysis for determining patterns of practice. In this activity, Ken played several video clips of teacher–professor interactions before playing the video clip from the chemistry class that showed Powerhouse members talking and laughing during another group's class presentation. After showing the clip, Ken asked teachers their perceptions of the classroom dynamics. During this exchange, Todd, the Powerhouse leader, tried to turn-shark Jenny to explain his actions during her group's presentation, but Ken did not allow him to interrupt:

Actor	Happenings	Actions
Jenny:	It looks like they [Powerhouse members] were not very interested in what we were saying, I guess. . . Or maybe they were, they were. . . they were going to add their comments next and we had taken all their comments. That might have been it.	Todd attempts to raise his hand to speak. Ken moves on to the next group member.

Ken allowed Todd to share his explanation for speaking only after all the presenters from Jenny's group (who had been dismissed by Powerhouse actions) had spoken. Todd insisted that he was talking to his group members only because Jenny's group had given "complete answers," which meant his group had to "generate new ideas for their presentation." He asserted that their lack of attention to Jenny's group was not disrespectful. Ken chose this time to introduce the concept of member checking, explaining to the class that this clip had been chosen as a fine example of why member checking must occur in research:

Actor	Happenings	Actions
Ken:	So member checking is when you go back to the individuals just as we did, so we went to Jenny, and we said, "hey, Jenny, what's going on there?" and she told us what was going on and that was her perspective. Uh, it got Todd's attention ( <i>class laughter</i> ) because he quickly said, "Whoa! Whoa! That was not what was going on at all, there was no disrespect there, we were doing this." (1.0) Member checking is this. It is when you do an interpretation of something, then you take it back to the participants and say, "Is this about right from your perspective?"	

In the above transcription, Ken explained the process of member checking as well as exploring the possibility that Todd and his group may have unconsciously been disrespectful. This public discussion of target student behaviors, supported by videotape evidence, and the use of variable group structures changed the class structure so that these teachers ceased public displays of disrespect toward their peers.

### What Was the Result?

During the remainder of the course, Ken continued to use his preset groups during three or four activities per class period resulting in a noticeable change in the classroom environment. Initially, teachers were reluctant to share in these new peer groups, but over time they became more enthusiastic about these changes and began expressing a preference for frequently altering group compositions. Teachers reported that they enjoyed developing new and deeper relationships with their peers. Video analysis revealed that teachers seemed awkward and guarded during topic discussions in the beginning of the new class arrangement, but over time they became familiar with one another such that their discussions occurred with greater ease and intensity, regardless of group composition. This was even true of groups that included individual Powerhouse members and the students who they disrespected in previous vignettes. In addition, during teacher presentations and whole-class discussions, disrespectful displays ceased. One teacher commented

on how effective she thought it was that Ken had been so explicit about his expectations for behaviors and how he made teachers aware of how he was changing the structure of the classroom to change the practices within that field:

I thought it was good the way Tobin talked about it [breaching strategies]. “I am shutting you down now. I am not looking at you, I am looking at my watch.” He practiced what he preached. I also think it was good the way Tobin handled the issues with Marnie. He handled it well. (Tina, cohort 2 member, interview, summer 2003)

As we mentioned previously, it is possible that some teachers were not consciously aware that their practices disrespected other teachers. Consequently, Ken’s explicitness served to emphasize the inappropriateness of some behaviors and make teachers aware of situations in which they showed disrespect to their peers. Teachers reported the continued use of structured activities that assigned peer groupings along with roles as a positive change that enabled participation from students who previously were quiet or silent. Teachers and professors alike commented on the changed atmosphere of the cohort, citing a feeling of greater camaraderie among classmates and more engaged participation from all teachers because of the clearer expectations.

Of particular significance is the fact that the changes observed in the education course were also observed in the concurrent chemistry course. This indicates that structural changes in one course affected practice in another, thereby transcending fields. Video analysis of subsequent chemistry courses in the final summer of their program revealed that cohort 2 members remained respectful when others were speaking and they continued to work in mixed peer groups as arranged by the chemistry professor (a strategy now employed by all chemistry faculty as suggested by this study). In an anonymous, end-of-the-year survey given to all cohort 2 members focusing on the quality of the learning environment as a result of the changes in the chemistry education course, teachers indicated that they felt their classmates supported their learning (4.56/5 on a Likert scale; where 1 = strongly disagree to 5 = strongly agree.) and that their behaviors and actions contributed to a supportive learning environment (4.44/5). Moreover, these teachers indicated that they generally felt accepted by their cohort members (4.12/5), that they could join any peer group at any time and be accepted (4.06/5), and were included in all peer groups (4.18/5). In general, cohort 2’s teachers stated that they worked well with all members of their class (4/5), but tended to work with certain groups of friends unless assigned to do otherwise (4.1/5). Finally, while the practices of professors and teachers in the class may have changed how some teachers were treated, a few still expressed a belief that some participants were not very knowledgeable about chemistry (3.25/5) or about educational pedagogy (2.94/5). Of the 17 surveys collected, two teachers reported that the opinions and ideas of all of the students in class were not equally valued by their peers (3.81/5). Given the small size of the survey sample, these low numbers translate into only three to five students reporting continued dissatisfaction with some of their classmates’ behaviors and or perceived academic abilities. In general, the teachers, professors, and evaluators recognized that the structural changes produced a more inclusive, supportive learning environment that expanded the agency of all teachers.

These findings support our belief that the porous nature of the boundaries between the field of the chemistry education courses and the field of the chemistry courses allows practices to diffuse from one field to the other field. This helped us to understand how the changes initiated by Ken in his chemistry education course carried over into cohort 2’s next set of chemistry courses. As a result, the environment for many participants improved in these final summer courses. This outcome suggests that professors can take advantage of this permeability factor to make and sustain positive changes across fields and over time. An implication of this finding for professional

education programs is that consistent integration of content knowledge and teaching practice should be a conscious goal of all courses in the program.

### Implications

These research findings have important implications for future studies of teaching and learning in professional science education programs. Specifically, this study has highlighted the need for professors, both those from the content areas and science education, to consider the learning environment and how implemented structures shape the teachers' practices in classes and other fields within the program. Thus, when working with teachers, professors should explicitly state their expectations of classroom participation and acceptable behaviors. This appears especially true with cohort models as the porous boundaries of fields enables inequitable practices from one field to be carried over into another, strengthening structures that systematically disenfranchise some participants over time.

The methods employed in this research were designed to catalyze social transformation by identifying contradictions within structures and then finding ways to alter these structures to expand the participants' agency. Adhering to the educative and catalytic nature of this research, we shared the results with the program's professors, teachers, administrators, and researchers to expand professors' and teachers' agency over time and across different fields. As such, this study provided administrators, professors, and teachers the opportunity to examine how teachers accessed and appropriated resources within the program and in the classroom with the explicit goal of maintaining a positive learning environment for all participants.

This study has also highlighted how a learning environment composed of adult students can become unproductive if structures reinforce exclusionary and target-student behaviors, which promote the formation of cliques. By identifying the influence of target students and clique members on the classroom climate, professors and teachers became more aware of the roles they played in structuring the classroom. A critical awareness of classroom structures diminished negative behaviors. However, using this approach requires extensive preparation and planning concerning program activities and management of group interactions. Some structures, including those described in the previous section, allow for greater participation of all teachers and provide a means from which teachers can become more agentic with their peers and the professor. Target students are not villainous and, in certain circumstances, have much to contribute to class discussions. The challenge for professors is to use target students' energy, knowledge, and practices in productive ways, while concurrently structuring the learning environment so that they do not dominate resources.

Developing a structure that provides a supportive learning environment for all students requires educating both professors and students about culture and practices. This seems especially true in science discipline-based programs where content knowledge is implicitly privileged by the structures used to admit learners into the program and also by the way professors teach and assess knowledge and practices in various contexts. When students learn science, they generally produce or reproduce this culture as they interact with the structures of the classroom. The way in which professors and their students experience this structure, and thus science, is largely dependent upon culturally and historically constituted practices that have been developed over time based on their lived experiences (Martin, 2005). For many program participants, science courses have been experienced as a rite of passage, something to be survived or endured. The science faculty teaching these courses have largely experienced college science classrooms in the same way their students had, and as a result they continue to perpetuate the structures they experienced as learners in their present-day teaching by implicitly reinforcing the privileges

ascribed to knowing science content. Providing structures in which knowing pedagogy related to science teaching is as valued as knowing science content is an issue that has implications for professional education programs that emphasize content knowledge and that are primarily taught by science faculty who are not informed by current research in science education.

As professional education programs continue to include content faculty, science educators can use the opportunity to introduce education research to university colleagues and the teachers involved in the program, because changing the structures of professional practice at the college level can have broad applications for changing the educational structures in other fields of university education. When we originally raised the issue of managing the learning structures with university professors, they responded by arguing that their responsibility was not to manage the learning of the students but to impart chemistry knowledge and that the teachers should be able to manage the learning environment for themselves. Implementing collaborative learning structures is not intuitive and both professors and teachers need to learn the strategies to ensure successful learning. We have found that cogenerative dialogues hold promise for providing a field in which teachers and professors have the chance to raise issues of concern.

Cogenerative dialogues are conversations between stakeholders about shared experience that can be used to identify and discuss classroom practices that are both unintentional and unconscious (LaVan & Beers, 2005; Roth & Tobin, 2004). Cogenerative dialogues were introduced into the MSCE program to consider the voice and views of all stakeholders including those who had been traditionally marginalized by practices associated with mainstream science culture. One of the chemistry professors used cogenerative dialogues to discuss issues of teaching and learning in his class (Martin, Roberts, & Emig, 2005). By including the voices of professors, teachers, and evaluators in these dialogues, participants have been able to examine problems emerging in the classroom and to work collectively on the co-construction of suitable solutions to the problems that were identified. In so doing, high school science educators have the opportunity to cogenerate a new, more inclusive culture of science learning. Some MSCE teachers are currently implementing cogenerative dialogues, a tool they learned in their college science classes, in their own high school science classrooms (Martin, in press). This research supports our continued efforts to collectively examine structures related to science teaching and learning, thus promoting positive classroom climates for all students and teachers at both the college and high school level.

#### Appendix: Transcription Conventions

↑	Rising intonation
↓	Falling intonation
—	(Underlined words)—words stressed
(1.0)	Silences, time to the nearest second
[	Simultaneous talk by two speakers, with one utterance represented on top of the other in the moment of overlap marked by left brackets
'	Pause or breath without marked intonation and laughter breaking into words without speaking
=	Interruptions or next utterance following immediately, or continuous talk represented on separate lines because of the need to represent overlapping comment on intervening line
( <i>italics</i> )	Simultaneous nonverbal gestures
[...]	Transcriber's comments

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