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Reflections on the Practicality of Good Theory

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Abstract: Jennifer Kennison noticed something different about the way her high school chemistry students were working together during Complex Instruction rotation. Her attention to the change in her students' learning caused me to think about how Elizabeth Cohen's often referenced Kurt Lewin's comment "There is nothing so practical as a good theory." As a result, I decided to ask two students who were teaching CI rotations if they would be interested in working together on a conference presentation that looked at their work through the eyes of Lewin's dictum. They would take on responsibility for documenting and writing about their CI units and I, their advisor, would take on Lewin. Both Jennifer, an experienced teacher and MEd. candidate, and Bethany Brodeur, a senior elementary education major, agreed to this task.   The resulting papers formed the core of our presentation at the 2004 conference of the New England Educational Research Organization. Together, they form a short volume that integrates learning about CI with the practical implications of implementation of CI at the elementary and secondary levels. This paper reports my observations of their work confirming Lewin's dictum and Cohen's wisdom. CR

Introduction

In her keynote remarks to a small professional development seminar for teacher educators from throughout the world, Elizabeth Cohen anchored her lecture in Kurt Lewin's dictum, "There is nothing so practical as a good theory." This statement implies several assumptions concerning the application of theory in applied settings, in this case two public school classrooms.

1. Good theory helps us understand and advance classroom practice.

2. Good classroom practice helps us understand and advance theory.

3. The dialectic of theory and practice creates a kind of crucible within which the achievement of desired outcomes can be understood at deeper levels through systematic inquiry.

This paper reports two sets of findings: (1) the necessary adaptations to a theoretically based cooperative learning strategy when implementation is pursued in two settings; and (2) reflective analyses by participating classroom teachers with respect to the necessary adaptations of practice and actual content learning gains.

Cases are presented from two settings: a multiage 1/2 classroom and a high school chemistry classroom. In both cases, student data will be presented in terms of content learned and student perception of the benefits and burdens of the collaborative process. In both cases, practice is theoretically grounded in the form of cooperative learning known as Complex Instruction. The tracing of classroom adaptations and learning gains is preceded by an explanation of critical elements of CI theory so the baseline of theoretically suggested CI strategies is clear. In both cases, strategy shifts will be noted by alterations of suggested practice. One example is mathematics instruction with first graders; the other is high school chemistry instruction related to the periodic table. We conclude with brief commentary by the lead researcher with respect to the dialectic of theory and practice in a time of shifting bottom lines in contemporary schooling.

Method of Inquiry

I'd like to say I had a semi-structured interview based qualitative research design in mind when I began this project. I didn't. What I was interested in was trying somehow to document and even illuminate how Lewin's dictum played out: how CI theory and practice form a kind of crucible "within which the achievement of desired outcomes can be understood at deeper levels through systematic inquiry."

Eventually, I pursued a semi-structured interview methodology. Each teacher taught a rotation. Each teacher kept a kind of reflective journal about the experience. Jennifer's interviews were through a series of emails we did together that focused on her rotation. Bethany's interviews were through the edits and commentaries we did as we talked through the paper she wrote for this conference.

Besides the writing and talking together, I gave each teacher a chart of expected CI practice that I distilled from my own knowledge of CI. The chart also provoked interesting conversation as each teacher thought about what they had done, and why, through the lenses of those "expected practices". I remember Jennifer looking at the chart and saying something like, "Did that, did that, not that. Hmmmmm. Not sure about that one. Combined those two." and so on.

These chart based conversations led to my asking each teacher the most important question of this research process. The question went something like this: "So when all is said and done, what were the main things you did that made CI work for you?" This

turned out to be a critical question. Each teacher directly addressed what she did that made CI work in the all important context of her classroom. And it is in these answers that we see the power of the theory/practice dialectic at work. Through these answers, I believe we see both CI theory and practice illuminated more deeply than any of us understood it to be before we began this project.

Theory and Practice

Critical Elements of Complex Instruction Theory

Cooperative Learning is a strategy for small group learning that has held sway for over forty years in educational practice. Cooperative Learning (Capital C and L) differs from cooperative learning (small c and small l) in that the capital letter version requires that several criteria be met while formally assigned groups of students engage together in learning activities. These criteria include positive interdependence, individual accountability, group processing, cooperative skills, and face-to-face interaction (Johnson and Johnson, 1987). When these conditions are met, Cooperative Learning (CL) strategies show consistent gains in student achievement. Psychologists David and Roger Johnson (1991), Robert Slavin (1995), and Spencer Kagan (1994) have all advanced different forms of cooperative learning.

So have Elizabeth Cohen and her Stanford University colleagues. Cohen's belief about poor student achievement, even in cooperative learning groups, emerges from her stance as a sociologist. For Cohen, low achievement is linked to the expectations other students have of a given student's ability to help them finish a task. If the given student is perceived to have little to offer to help a group complete a group task, that student will not be included in the all important talking and working together of the group. That student has little status in the eyes of his or her peers and becomes silenced in the classroom conversation.

Cohen has created a form of cooperative learning practice called Complex Instruction (CI) that is grounded in Expectations States Theory (Berger, Cohen, and Zeldich, 1966). Thirty plus years of CI research have linked student learning and achievement with the opportunity to talk and work together in content related activity. Low status students don't get to talk and work together with their peers because their peers think they have little or nothing to offer. They become low achievers, silenced, or

resistant saboteurs of learning in the classroom. Cohen suggests a planned set of instructional strategies including status treatments to equalize student status in groupwork situations so that all children are able to talk and work with each other at high rates, thus leading to learning and achievement for all. These multiple strategies include social structure interventions (using group roles, invoking collaborative norms, teaching collaboration skills), curricular interventions (groupwork, use of big idea to organize rotational, rich, and redundant learning activities), and status interventions (posting requisite multiple learning abilities, assigning competence to low participating students) in order to engineer higher rates of performance. Figure One. illustrates the major intervention categories of CI.   Table 1. lists requisite conditions of practice as they connect to the theoretical base of CI. To do CI well requires that all the categorical areas of intervention be implemented by using proper practices. No wonder the overall strategy has been called "complex". It's a complicated but powerful instructional tool for which social order is a means to the end of higher academic achievement. A more detailed description of CI is included as Appendix A.

CI is a well articulated theory that in practice, enables all learners to learn more when implemented well. "Implemented well" for purposes of this paper means that all the categories of intervention (Figure 1.) have been utilized. Even the students who usually do fine in group tasks will end up having higher rates of learning after a CI rotation is completed. No wonder Cohen is fond of quoting Lewin when talking about CI. The implementation of CI practice is well articulated in several sources (Cohen, 1994, Cohen and Lotan, 1997). It is not easy to accomplish.

Real classrooms in real schools with real organizational cultures and structures can present challenges to the "proper implementation" of CI. So what happens to theory and practice when context variables conspire to make the groundwork for implementation less than ideal? This question is what we will look at next by examining how two teachers in two different settings went about dealing with their own unique contextual challenges. What were the contexts? What adaptations were necessary? What happened to the requisite practices called for by this eminently practical theory? What can we learn from the adjustments these teachers made about the theory of CI itself? And what service did the theory provide that helped them to inform their adjustments? These are some of

the questions related to "nothing is so practical as a good theory" that will be addressed in these next sections.

<p style="text-align:center">Necessary Adaptation One: The Multiage Classroom</p>

Bethany is a very able Senior in the elementary education program at the University of Vermont, soon to graduate. She completed her fifteen week student teaching internship in December, 2003. During that internship, Bethany had to teach a CI rotation. She is an "expert" novice. By this I mean that she is new to CI, is new to full responsibility in the classroom although she's had over a hundred and thirty hours of university supervised field work, and is learning how to put the entire range of classroom responsibilities together for the first time. In a very complex setting, at that.

In the context of her school experience, Bethany could not carry out an ideal CI rotation. In one of our interviews, she described how the introduction of the CI assignment in class had no connecting points for her.

• First of all, she's teaching first and second graders. The first graders are completely new to the school, its October, and so far, they've done no groupwork whatsoever.   She had to begin her rotation in late October. How to get the kids ready for working collaboratively in groups is as much her concern as "doing ci".

• She taught in a school that prides itself on being able to meet the needs of every child and one way her school pursues its mission of meeting the needs of every child is to regroup children for almost every content area. Bethany had precious few times during the week when she had the same group of children long enough to meet the demands of a rotation. The school may in fact minimize status inequalities among its students because of their long and careful focus on the child. We also know from the research that status issues exist in task driven environments and Bethany may not be seeing them quite yet.

• Finally, curriculum was highly prescribed in this school so the thought of designing a rotation attached to a longer unit of instruction was daunting. Units were prescribed, not invented, especially in mathematics. The school used a highly structured, graded, standards-based, and well known mathematics program. Four teachers split and shared instruction. How was Bethany with a split schedule and constantly regrouping children going to have enough children consistently together to do this kind of work?

So, Bethany decided to use the most consistent time period of her internship – mathematics instruction – as the focus of her CI. She decided to teach first graders who for the first time ever this year, were taught math in same age grouping arrangements. She decided to use problem solving as the curricular focus of her CI work because that was what the master plan called for. Rather than designing a conceptual unit focused on the big idea of an interdisciplinary unit, Bethany designed a CI rotation in mathematics focused on group based problem solving. Her organizing idea involved the understanding that "people can work together and be resources to each other to solve complicated mathematics problems" and the content objectives she designed included (1) observing an increase over time in the number of strategies students used to solve open-ended math problems, and (2) whether the students acknowledged the power of group collaboration using each other as a problem solving strategies.

Her paper describes how she designed her CI mathematics rotation and how its instruction proceeded. When she writes about making it work, she focused a great deal of attention teaching the children about groupwork and the group roles by focusing their attention on the behavioral characteristics of whatever she was looking for.

Leading up to our CI work, the students and I discussed what groupwork should look and sound like. We created a T-chart of these examples. For instance, students all agreed that only indoor voices should be used, manners, and listening to group members were all important examples of what groupwork should sound like. The students then defined these examples further and explained to me what listening would look like. Students told me that I would know they were listening because no one wlse in their group would be talking and all group members would be making eye contact with the speaker. I thought that the students responses were very detailed.

Later, she writes about using the same tactic with the norms of working together. She identified these with the children, she role played them with the children, and she generated a chart of collaborative skills "*they thought were necessary in order for groupwork to be effective.*"

- *Good problem solvers need to work together.*
- *Share ideas.*
- *Use several strategies.*
- *Use math tools to show thinking.*

- *Most importantly, good problem solvers must have fun solving problems with their friends.*

Bethany also used this form of social skills modeling when she introduced the group processing roles to her children. She knows the roles connect with CI theory. *"One of the goals of CI is to introduce group roles and increase the students' academic confidence in the eye of their peers."* She introduced all the roles with the same degree of enthusiasm (facilitator, recorder, reporter, materials manager) in order to ensure the equality of each of the roles in the eyes of her young students. Again she made a chart and outlined each role and its responsibilities. And then, to really emphasize the importance of each role, she "*created a ceremonial setting. I called students to stand up in our circle as I placed their role card around their neck. Students, regardless of their role, smiled and appeared to be very proud of their responsibility. The students enjoyed wearing their role card. To many, it felt like a badge of honor and it served as a friendly reminder to group members and myself as to what role each student was responsible for.*" Bethany worked hard to teach these young learners how to work in a group and manage their own business. And she clearly saw this process as the foundation of her success.

Each of her four groups had a different open-ended problem to solve. Each group chose to use slightly different materials to solve the problem. She waited until the last day to have the children share their solutions for fear each group would borrow solutions from other groups. When the groups finally did share, she was enthusiastic about their presentations and we see her relief at her being able to observe the children helping each other in their group interactions.

These students made tremendous growth in the area of problem solving. Most importantly however, they grew as peer supporters. I observed this in a number of ways:
- *Sharing ideas and making eye contact with the speaker.*
- *Using "I" messages when sharing their thoughts and providing feedback.*
- *Taking turns helping one another with their responsibilities.*
- *Complementing each other's ideas and hard work.*
- *Giving encouraging and supportive comments to their group members.*
- *Including everyone's point of view and ideas.*

She sent the post-test home with the children before calculating pre/post content acquisition data. She noted, however, that *"the posttest did reveal that students learned to use new mathematical manipulatives (counting bears and unifix cubes) and more than half of the students recorded that they now used friends as a tool."* No student mentioned "using each other" as a problem solving strategy in the pre-test. Bethany also had to keep special watch on four students of especially low status in her room, even though she thought the status measures done earlier in the course *"were not as reliable as in other school settings"* because of the attention this school pays to every individual student. For these students, her assessment noted that *"these individual students were able to be successful, positive, and contributing group members. They sat close to their groups members, asked questions, and spoke assertively when offering their thoughts. Group members supported these individuals by rephrasing statements, offering positive inclusive gestures such as an arm around the shoulder. Tracking* [these students] *allowed me to identify more results CI had in my classroom."*

When asked what the main things were that enabled CI to work for her, Bethany succinctly mentioned four conditions:

1. The overall context of the school environment.
2. Connecting the social and academic classroom structures of the classroom.
3. Making each role unique and special.
4. The specific use of T-charts and skill building.

What she seems to be saying is that academic objectives cannot be pursued without gaining control of the social structure in a classroom. In her case, the very specific modeling and teaching she did on social and collaborative skills as part of the social structure of this classroom is what allowed the children to be successful with their academic tasks. Clearly, she perceived her social skills teaching as supporting and being supported by the "overall context of the school environment." Although she didn't mention the CI norms per se, she did extensive work on collaborative norms and she mades sure the groups knew how to go about their work using the group roles to guide and focus communication and task activity. In these ways she acknowledged that the structure provided by CI enabled her to know what to do to get the children to work together successfully in the service of academic outcomes.

She's not particularly strong in her use of status treatments. This is in keeping with her perception that significant status issues are not present in her classroom. She noted one instance where she assigned competence. Her writing demonstrates a level of technical expertise with this particular status treatment.

If this was not exactly CI in its fullest form, it was groupwork well carried out and groupwork that was quite successful. Although it seems her efforts may have created conditions of more equal status, we don't know this for sure and we never do. We do have her word that her target children prospered and participated and it is for the academic success of these less participating children that the power of CI is intended. It appears she was successful.

Bethany adapted CI in several significant ways made visually apparent by the photographic record of her rotation in the Appendices to her paper.

(1) The curricular rotation involved similar activities. The problems were all mathematics exercises. They were open-ended and able to be solved in a variety of ways, but they were all math problems. So in one way they were rich tasks, but the use of multiple abilities was constrained because they were all math problems.

(2) The group task was talking and helping each other figure out how to solve the problem but this was not a case of all the children working towards one group solution. Each child was in each group was working to solve the group problem individually.

(3) She chose not to academically debrief the children each day thus limiting what they could learn from each group's solutions. On the other hand, because this was their first time doing groupwork, she did debrief how well the groups were working together and this may have contributed overall to the outstanding academic success she reports on the final day.

(4) She used the assigning competence status treatment once. Assigning competence is not an easy thing for teachers to learn so the fact that she gives us one example in her paper is impressive. Though she fails to mention the other status treatment, the multiple ability treatment, her pictures show the range of problems presented and the range of solutions offered. Clearly, the children were seeing lots of different ways to solve these problems. We don't know what would have happened if Bethany had chosen to point this out to the children prior to each day's activities.

But, as she said at the outset, almost everything here was a first time event. The children hadn't done groupwork before, She hadn't done CI before. The children were new to problem solving in mathematics. They hadn't used group processing roles before. In light of these constraints, this is a well considered and apparently successful adaptation of CI. Her writing is revealing of a fairly deep and interconnected knowledge of CI. Her focus on roles isn't just because that's what you do with CI. She knows how they affect group interactions and how they can provide verbal access to the work of a group for silenced children. Her training procedures are exemplary. She teaches social skills the way Bandura says they should be taught (Cohen, 1994). Most impressive is the work she accomplished before starting the rotation. She knew that tackling the social skills work first was critical, but not the end point of CI. By the time these six and seven year olds started their group work, they knew how to work together, they could tell you how to work together, and they evidently adjusted the inevitable ups and downs of day one to make days two, three, and four very successful in the eyes of their novice teacher.

In her recall of the four days, Bethany mentioned several times how she "let it be." In CI terms, she worked at "delegating authority" to the children. She "rarely intervened." When she did, she huddled with like role groupings of students rather than interrupting the groupwork with excessive hovering. Delegating authority is solidly in line with CI theory and one can't help but hypothesize that her delegation of authority to the groups interacted with the training she'd done with the groups and the T-Charts she had placed as behavioral reminders around the room and on the work tables, another adaptation of CI practice When things went awry, the children had multiple ways of identifying what was going on and skills within the groups to self-correct. An occasional reminder from a group member (who'd been reminded by the teacher in an ad hoc huddle) would surely have helped. All very CI –like in execution.

Despite the very real constraints she faced, CI theory provided Bethany a road map to alter her practice to deal with her constraints while doing what she needed to do to make groupwork work. Her writing is more technical and utilitarian than theoretically reflective but it is useful to remember that this is a young, novice teacher who is putting a theory to practice in order to meet a course requirement and implement a complicated instructional process. It is little wonder she's more focused on the "moves" rather than

the reflective application of theory. The theory works for her. Her successful practice is a useful example of (CI) theory being of practical use to her. She reasons within CI theory, she makes decisions to adapt her practice using CI theory, and she experiences positive outcomes. In her case, theory is informing practice.

<center>Necessary Adaptation Two: High School Chemistry</center>

Jennifer is in her nineteenth year of teaching. She is a thoughtful, experienced, reflective professional. She teachers currently in a high school of 1200 students with broad socioeconomic diversity. Her responsibilities include four sections of chemistry in a given trimester. Her students are mostly juniors, "but can include 'accelerated sophomores or straggling seniors." The high school is heavily tracked, especially so in science. Jennifer's classes number 24-26 students. Her students range "from those who have clearly had many opportunities to learn science and math to students who have not experienced success in either math or science."

From her point of view, she had two areas of necessary adaptation when considering CI. First was the issue of tracking. It could be that academic diversity in her classrooms was limited because of the tracking system. But in fact, she saw it differently. She saw that with the addition of those occasional sophomores or seniors in her predominantly junior classes, the academic diversity could be potentially challenging.

The second challenge was the system of trimesters. It affected her instruction in two ways. First, she had the students for only 12 weeks. Not a lot of time to teach a subject matter as dense as chemistry. Second, students were shuffled between trimesters so she could never have a class return whole for a second go-round at instruction. She had them once, for 12 weeks, period.

I add a third challenge. Jennifer attempted CI at the high school level.   In our work in Vermont, we found high school teachers were resistant to using formal CL strategies. More traditionally oriented high school teachers reported the use of CI strategies might appear "mickey-mouse" to high school students. The use of roles, collaborative norms, the whole idea of assigning competence would fall on deaf ears. "Kids don't want to seem like they are doing elementary school again." Other teachers reported that they "have the kids working together all the time and still, some kids take over and other kids sit back and let the smart kids do the work." Ironically, this statement

underscored our reason for why CI should be pursued at the high school level. It lessens the effects of social dominance in learning situations.

Jennifer is not of this belief. She was selected to be a Teacher Associate with the statewide math/science systemic grant after her seventeenth year of teaching. She reported that her first "aha" of this year was realizing that "*as a science teacher I had always been aale to say that, yes, students in my class worked in small groups. We veteran science teachers pride ourselves on student lab partnering. But, I realized, I had never taught students to work in a group. How could I have overlooked such a basic idea for so long?*"

She had the opportunity to learn about Complex Instruction during this year and in a follow up course on differentiated instruction, she became intellectually engaged with the integration of collaborative skill training and academic pursuit that are both central to CI theory. She was determined to try CI when she reentered her high school classroom. As she wrote, her paper "*is simply an attempt to put into writing an experience in the design and implementation of a CI rotation at the high school level. Although the experience described here is a defined point in time, my continuing experiences and reflections on CI are a moving target.*" Jennifer never stops thinking about her teaching. A conversation with her is to open yourself up to the possibility of an insight a minute as thoughts about her teaching are dissected, reflected, and projected into an instructional opportunity in the near future.

Jennifer opted to craft a rotation around the organization of the Periodic Table of Elements. She recognized the table was easy for her, the "expert", to understand because of her understanding of the patterns that undergird its organization. To know the table was to know its patterns. "*This is easier said than done for students, the "novices".* She goes on to write,

In recognizing the discrepancy between the way that I perceive the periodic patterns and the way the students struggle with them, I knew that students needed to interact with this content more intimately and from their own perspectives in order to construct understanding. Previous teaching experience had given me a small arsenal of activities that could lead to student understanding. It was my intention to retool these activities to create redundant learning opportunities that were rich enough to engage

students in dialogue and rich enough to cause students to confront their own misperceptions.

What is so clear in her writing is that this is an expert teacher talking about her craft. She knew her students had to experience the patterns of the table for themselves. This had to be an active process of constructing their own knowledge. That the process had to approach the same big idea in several different ways – redundancy – and that the students had to use language well enough to understand the patterns from the inside out in order to face their own misperceptions. The truth of the table had to be so clear to them they could use it to clear away their faulty understandings. She knew that CI's essential ingredient was talking and working together and that if done well, CI could give her the "rich opportunities" she sought for her students' learning.

She adapted activities she used in the past. Good activities. Engaging activities. But activities that stood alone. By re-designing them into a rotational format, she made the students use the same body of knowledge differently across each activity to drive conversations within the groups deeper and deeper as the students applied their expanding knowledge of patterns within the table in each different activity each day during the rotation. This was a skilled use of the idea of redundant learning built into CI rotational activities. She used the report-outs not for the provision of answers but for the identification of difficulties, how those difficulties were solved, and advice for the next group taking on that particular activity. And all the time, her activities required the application of scientific knowledge, understanding, and language.

Like Bethany, she delegated authority to the groups. She used her own adaptation of roles (facilitator, materials manager, director of display, and director of logic) to focus conversations within the groups. Her activity and resource cards, another way of focusing group efforts, were exceptional. And she posted and reviewed daily the abilities needed to complete each task – the Multiple Abilities Status Treatment. She established mixed expectations for competence. Her student knew that a variety of skills and abilities would be necessary to do these tasks, tasks which are both group tasks and individual tasks. Each group had to produce one display for the report-out session that occurred every day and every student in every group had to respond to an individual report as a homework assignment.

Students could access her only through one particular student in the group, the materials manager. She was free to watch the progress of the various groups and to listen in on their thought processes. She called short meetings of like role students for particular purposes, all related to pushing thinking in the task at hand.

Jennifer also experienced the first day jitters that students felt. *"Day 1 found the students scrambling to finish within the allotted time. I expected that this would be the case as each job was huge. Students learned in the first day that the next two days would need see increasingly efficient time management if the group was to "finish". Also significant to note is that on day #3, all groups finished comfortably. This was a function of increased student focus and the fact that students were making gains on understanding content each day. The concepts needed to complete the tasks were more readily retrievable."*

She measured success by anecdotal evidence of student learning. She points to

- Continuing use of scientific vocabulary by students as it relates to the content addressed in this rotation;
- Ease of recall of the patterns exhibited on the periodic table by students who experienced this rotation;
- Student application of the ideas experienced in this rotation.

The evidence stated was more visible to her with the mid level track. She ends this section by writing, *"This is, by far, the most understanding exhibited by the mid level students that I have witnessed in my career."* This statement underscores the comment to me that I used for the title of this paper. *"There's something there that's got my attention. It's got their attention as well."*

Jennifer noted that her student expressions of learning were more powerful indicators than her own observations of learning and to this end, she included nine student comments. Her selections refer both to the interactive facility of the groups ("…everyone had a job and it made the "work time" go smoother") and basic academic learnings ("I know that the alkali want to give electrons and the halogens want to gain and electron."). Jennifer has shown that written student reflections are a surprisingly powerful indicator of learned academic competence at the high school level and merit

further study as we learn how to implement CI with older students. Clearly something did have "their attention" as well.

What made it work for her? She mentioned three areas in her response.

First was something that could only happen with an experienced teacher. But experience was not the only criteria for this quality. Jennifer wrote that the concept of redundancy was a "huge shift" in perspective for her. *"Curricula are generally viewed as a sequence; I now view every unit through a filter of possible redundancy. Not every unit provides appropriate redundancy in my experience, but some do. Further, some content should be visited in a redundant way as it is difficult for students to grasp the first time through or only from one perspective."* The focus here is on content acquisition and the best way to achieve it. Moving away from sequence as the preferred mode to another way of thinking about how knowledge is constructed was central in her learning and in her practice.

Second was the same area Bethany thought about, the preparation for groupwork that led up to the actual rotation. *Students needed to have some experience with group work roles and with group work skills. This training was subtle for some weeks and then became more direct when I used specific skillbuilders suggested in Elizabeth Cohen's <u>Designing Groupwork</u>.*

Finally, Jennifer writes about the student journal entries. They still echo her developing understanding of what her students learned. They showed her "*the correct use of scientific vocabulary in the appropriate context; they seemed a reflection of student understanding.*" The students knew they knew. And as she reread them in preparation for writing this paper, she was "*stunned by the evidence they showed of concept attainment.*"   In reflecting on the social and academic learning that resulted, Jennifer wrote, "*The clientele that I deal with as a high school science teacher has had 11 years of training in a system that creates competition in the classroom. These students do not know, instinctively, how to learn cooperatively. ...More powerfully, after students have learned the prerequisite skills and attitudes needed for effective group work, they too will tell you that their learning increases when they are engaged, with their peers, in conversation over a big idea.*"

Jennifer has kept her eye on the academic focus of her CI work. And clearly, the application of CI theory has helped her do this. She used at least one status treatment regularly. She prepared the students to work together before requirement that they work together. Her activities were complicated packages of redundant knowledge. She kept out of the group conversations and let the students listen to each other. She structured wrap-ups so that essential information was forthcoming. And in the midst of all of this, you get the idea that her respect for her students as learners capable of deep reflection, grew. Her excitement as a teacher grew. And the knowledge of her students, grew. More so, she says, than ever before across the years of her career.

Jennifer's rotation is more "purely CI" than Bethany's because she has fewer contextual events she can't control. She noted that her clientele had 11 years of competitive structures behind them and still, they adjusted to this most guided and cooperative of learning situations. She had to have made that work. How, with the exception of her acknowledging the importance of her pre-rotation preparation, is invisible to us. She sees this preparation as necessary but not sufficient. What she writes tells us that her focus is content acquisition. Her focus is on how to enable her students to construct new knowledge or modify old knowledge of the periodic table in an interactive, collaborative, and multiple abilitied fashion. All else serves this end. In this she was successful. To this end, her focus on redundancy is her most significant adaptation of CI theory. She worked hard to create it across her activities, to build it in to her rotation, and she even employs the multiple ability status treatment to foster its application.

<div align="center">The Dialectic of Theory and Practice</div>

What areas of Complex Instruction are now understood at deeper levels, at least in terms of this analysis of two different contexts?

<div align="center">*Preparation for Groupwork*</div>

Both teachers wrote that preparation of their students for groupwork was absolutely essential to the eventual success of their instruction. This was as true for the six and seven year olds as it was for the sixteen and seventeen year olds. Bethany utilized group discussions, role playing, dramatic representations, and T-Charts to teach

her youngsters. Jennifer talked about the subtlety of getting high schoolers ready for groupwork and then doing very specific training where she built the skill structures with them by using several of Cohen's skillbuilder activities. Both teachers were highly focused and intentional in preparing their classes. We see through their examples that there are multiple ways of pursuing this preparation. The important point is that it be done in plenty of time for the actual groupwork to begin. In both cases, Jennifer and Bethany continued to problem solve the group work as their rotations proceeded.

The second point to make here is that the groupwork training was not an end in itself. For both of them, effective group discussion was key to being able to focus attention on the academic issues at hand. "If teachers want more articulate and abstract discourse, the students will need to be taught specific skills for discussion and for dealing with each other. These are not an automatic consequence of cooperative learning. Many students have no strategies for dealing with disagreement and conflict other than physical or verbal assault" (Cohen, 1994). This is one instance where theory gave direction to preparing the class for what was to come. The preparation looked quite different in each classroom but accomplished the same end. Theory guided practice in this case without prescribing exact method. The methods of preparation that followed, and subsequent success in the rotations, reinforces the theory based need for prior preparation. Thus the connection between theory and practice was affirmed.

Status Treatments

Central to CI practice is the importance of equalizing status among learners within groups so as to gain the participation of all learners in a group. Establishing mixed expectations for competence is essential as is assigning competence to the quieter students so that the remaining members of their groups will see that a student has something important to offer to the groupwork that is going on. These are the two status treatments (Multiple Ability Treatment, Assigning Competence Treatment). Theoretically, it is the status treatments that should trigger the change in participation rates, supported of course by students having specific roles, collaborative norms guiding the interactions, and rich curricula fueling the group investigations. All these treatments seem highly interactive as they affect learning. It is the status treatments though that gain the participation of the quieter members of the group.

Both teachers accomplished several status treatments but providing details of their treatments was not a strong part of their reflections. Jennifer emphasized her multi-ability treatments and Bethany mentioned assigning competence in one specific instance. Yet both claim their rotation's academic success for all their students. We are less certain whether or not the strong theoretical invocation towards status treatments had much effect in the practice of these teachers and in the learning of their students, at least as their practice was reported in their reflections. Theoretical necessity in this case seems less confirmed by practice. At the same time, the presence and powerful use of group processing roles, well articulated activities, follow up discussions, and preparation for groupwork may have had a kind of interactive dulling effect on the necessity for status treatments. With so many aspects of suggested practice in place, it is possible the necessity of status treatments became less vital.

Redundancy

If students believe another student knows nothing about what they have to learn, they are less likely to include that student in the learning process. They operate with an expectation of incompetence and once formed, that expectation resists change. "… an actor's position relative to another on the observable power and prestige order in the group is a direct continuous function of his or her expectation (dis)advantage relative to this other in the group. (Berger, Wagner, and Zeldich, 1998). In other words, learners position themselves on given tasks relative to perceived power and prestige. Little perception of power means no reason to engage.

The question this expectancy position raises for teachers is how can we create curricular situations that will enable students to see each other as powerful contributors to the group learning process? How can we create conditions that change the expectation of useful contribution from negative to positive?

One way is through the application of redundancy in conceptually based, uncertain learning activities. What redundancy means is that several activities address the same learning goal in several different ways. Jennifer designed three activities that called upon several different learning strengths to help her students see, understand, and represent patterns in the periodic table. Bethany used mathematics problems that required different solutions and solution paths in order for her students to learn how to

solve problems and how to use different tools and each other as resources in that process. In neither case was there and easy and only answer to the tasks at hand. By requiring thought that caused students to reason over and over again as they worked their way through their tasks, and by designing tasks that drew on student strengths, the students had to talk about their work in several different ways. They formed a more complicated set of conceptual linkages than if they'd been working on task that was directed towards one outcome. This redundancy, then, created a setting where students were more able to see and understand each other's strengths and potential to contribute to a successful solution. This is the essence of redundancy and both teachers designed tasks that embodied the principle. Redundancy is one way of confronting the expectation principle stated at the outset of this section. It opens the way for assigning competence to have its own effect.

For Jennifer especially, viewing curriculum as a potential vehicle for redundant learning as opposed to sequential learning was a powerful epiphany. With sequence, you miss the point and it's gone. In a redundant curriculum, "the point" will come back at you one more time is a slightly different form. This practice in the service of a more equitable learning environment, the damaging theoretical expectation principle being confronted, is now part of her active teaching decision making process. For both teachers, the theoretical power of the expectation principle formed a basis for instructional decision making. Because of her years of informed experience, Jennifer's understanding of the promise of redundancy for her daily work has a far greater breadth. For Bethany, designing those multiple ability rich tasks works just fine.

Conclusion

In each of these considered examples, theory and practice worked together to inform each other. Referring back to Figure One, Complex Instruction is not theoretically whole unless it involves a coherent set of social structure interventions, curricular interventions, and status interventions. Each teacher was true to this theoretical perspective in a different way, the differences being imposed by personal preference and experiential background and the school contexts within which the practice took place. Each category of intervention can be seen in the fabric of their CI instruction and though their classrooms were quite different, each application was true to itself and to the

theoretical dictates of CI. The same thing had been done differently. Fidelity to practice remained true to each practitioners place and person, and evidence was presented that their students learned and achieved essential information in the process. In short, three processes of reciprocal validity were at work: the individual teacher and her teaching, CI theory and practice, and the researcher and this research. I would like to close with my own reflection on the latter.

As this project progressed, the researcher became increasingly discomforted that something wasn't quite right in the lines of authority here. It felt that I was holding these teachers' practice up to the traditional critical scrutiny of a positivistic research paradigm. "Were they doing it right or not?" was the question I wasn't asking but which kept creeping back into my consciousness.

The discomfort was resolved by my realization that finally conceptualizing CI as having three areas of intervention is what allowed these examples of CI implementation to be different and yet the same. Practice is going to vary. Addressing the necessities of those needed areas of intervention within CI practice cannot. To do CI well is to implement instruction that works coherently with the social structure, the curricular structure, and the status structure of the classroom. Jennifer and Bethany's practice expanded our knowledge about how each of these interventions can work. And the necessity of these interventions drove Jennifer and Bethany to make certain design decisions given the realities of their settings and each of their understandings of CI theory. Theory and practice. Each informed and drove our understanding of the other.

A final dynamic here is the idea of research and practice being in a horizontal line of authority with one another. This means researcher and teacher must maintain that same positionality. It is a statement of the democracy of this kind of research enterprise where theory and practice are intersecting fields of tension, where both become detailed when placed in a given setting, and where learning about teaching is achieved and better understood because of the tensions each imposes on the other. If either assumes a permanent domination of the other, the process becomes tilted, less useful to one party, misaligned in terms of the democratic agreement. The equity expressed here is an equity of mutual respect for the existence of a field of knowledge in each member that is

absolutely critical to the success of the other. Arrogance on either part, the researcher or the teacher, the theory or the practice, means both fail.

I doubt these final understandings of how theory and practice stand in relation to one another would have happened if I hadn't seen Bethany and Jennifer speak with each other about their teaching. It only happened once, but it was a profound moment for me. What drew their impassioned conversation together for me was its form, the theoretical line of reasoning that grew from their individual knowledge of CI. This understanding was the frame, the warp and weft, the social and academic loom, upon which the threads of each teacher's instructional tapestry was woven and revealed and communicated.

Theory and practice. Social and academic structures. The democratic loom. We work together to understand. We work together to create powerful, relevant learning environments that reflect Dewey's necessities for practice that is both child centered and subject centered (Dewey, 1902). Lewin told us "close cooperation between theoretical and applied psychology can be accomplished…if the theorist does not look toward applied problems with highbrow aversion or with a fear of social problems, and if the applied psychologist realizes that there is nothing so practical as a good theory (Cartwright, 1951)."

Appendix A.

Expanded Explanation of Complex Instruction

While Cohen agrees that the overall goal of increased academic learning usually occurs in these varied forms of Cooperative Learning, as a sociologist, she turns a close eye to the within group interactions that often occur during conventional Cooperative Learning groups. She notes that while overall achievement may rise in conventional CL groups, within group observation may note the existence of social dominance by individual group members resulting in overall gains for the group but limited or non-existent gains for some members of the group. Drawing from years of research in Expectation States Theory (Berger, Cohen, and Zeldich, 1966), Cohen notes that limited or non-existent achievement by some group members occurs because those individuals have little or no status within their group (Cohen, 1996). For whatever reason, influential group members see their low status peers as having little or nothing significant to add to the group discussion. As a result, these lower status students are not heard or even recognized even though they may try to enter group conversations. As a result, over time, they become silenced. What results is a situation where the academically rich get richer and the academically poor get poorer. Overall, classroom achievement levels may rise. For certain individuals, however, achievement may consistently lag behind or actually decrease.

During the nineteen eighties, Cohen and her colleagues perfected instructional techniques to engineer interactions within cooperative learning groups so that status differentials might be more equalized. Cohen showed first in elementary school settings and them in middle school settings that status differentials could be treated resulting in more equitable rates of talking and working together among all students in a group. When this occurred, every group member's achievement rose, even those for whom achievement gains had been a distant hope.

Cohen's Complex Instruction includes some of the more familiar aspects of other forms of CL. For example, CI advocates the use of *collaborative classroom norms* so that all children understand that cooperation if a valued disposition in their classroom. CI advocates the use of *group roles* so teachers can safely delegate teaching authority to each group because the process functions of the group (facilitation, reporting, recording important data, material gathering and so on) are built in to the group process. Finally,

CI advocates *cooperative skill training* so that learners know how to work together before endeavoring to succeed in their groupwork. CI includes aspects of the *group processing* function of CL in daily teacher conducted wrap-ups to groupwork as each learning group rotates through related learning tasks on succeeding days. Anyone familiar with CL will find the visually apparent strategies of CI familiar.

CI differs from conventional CL in at least two notable ways. First, there is the matter of the *curricular rotation*. Operating from the learning principle of redundancy, CI theory advocates the use of four to six conceptually based learning activities organized around a big idea. Practitioners are urged to use CI after a unit of instruction is well advanced. The teacher selects a big idea from the unit and designs several groupwork learning activities that address the big idea. For example, a teacher involved in teaching the American Revolution may select the big idea of "conflict is enhanced by different points of view during wartime" as her big idea. The learning activities she designs will engage her students in several different examples of how differing points of view played out during the Revolutionary War.

These learning activities will be designed to draw on multiple strengths present in the classroom so that no one particular learning skill guarantees content achievement across all tasks. This is exemplary of the second way in which CI differs from CL. CI theory advocates the use of Status Treatments to change the way students perceive each other as potential contributors to successfully completing the various learning tasks. The first status treatment relies upon the teacher establishing *mixed expectations for success*. That is, by designing learning activities that use several multiple learning abilities, the teacher can point out to all her learners that no one in the class will be able to be as smart as everyone can be together. The teacher keeps an ongoing list of multiple abilities that help her students complete their tasks successfully. The list is kept publicly in full view of the class and is usually referred to at the beginning of each rotation. Often, students help her expand the list once the rotations have started. This process is one treatment for status inequities. It is designed to communicate to everyone in the class that mixed abilities are needed to complete the rotation successfully and that no one person in the class has all the abilities. This treatment is called the Multiple Ability Treatment.

The second status treatment is rendered when a student, especially a low participating low status student, is see behaving in such a way as to be helpful to the group. The teacher will move into the group and say something like, "I'm noticing that Jimmy has brought in an important fact from his outside reading and that fact can be very helpful to your group. Using outside resources is an important ability to have and it will help your group be clearer about what to do with your cartoons. Good researchers use lots of outside resources." This is the second and only other status treatment advocated by CI theory. It is called *Assigning Competence* and its purpose is to perk up the other members of the group to the fact that Jimmy has done something useful and contributory to the group's eventual success. What usually follows is that the group begins to pay attention to Jimmy's contribution and Jimmy begins to talk and work together more as part of the group's process.

Research has consistently shown the power of CI in boosting learning rates not only for the lower status students in a group but also for the more usual high achievers in group (Cohen et al, 1997). Everyone learns more in well orchestrated Complex Instruction. When groups achieve rates of talking and working together that approach 35% of a group's total interaction during groupwork, learning shifts into overdrive and effects can be seen for all students (Lotan, 1997). Theoretically, "doing CI" involves using all the instructional steps during implementation.

Appendix B.

Planning Sheets Used By Teachers During Their Writing Process.

Planning Sheet Used For Neero Conference
April 22-23 Portsmouth, NH

Elements of CI Practice	Theory Based Practice	Actual Practice	Conceptual grounding
Collaborative norms	•Post ci norms •Point out norms in groupwork or classroom •Model norms		Groupwork works best in the presence of a classroom climate that evidences respect for differences and reciprocal helping. "Getting along" is not the #1 focus. A focus on academics is.
Collaborative skills	•Teach social skills using skbds •Teach groupwork skills skbds •Start skillbuilders 3-6 weeks before rotation •Model skills •Post social skills (T-Charts)		Collaboration is a learned set of skills. Successful collaboration can be expected only if the skills of collaboration have been experienced and taught.
Taking care of group processes	•Teach roles using skillbuilders •Post roles		Groups get empowered when teachers delegate the authority and responsibility for group success to the group

Planning a Rich Curriculum	•Focus on multiple ability tasks •Groupwork •Groupwork tasks (better done with group, can't be done individually) •Tasks designed around a big idea		All learners need access to an interesting, relevant curriculum. Planning strength based tasks assures all students will have access points to learn. Planning around a big idea ensures rehearsal, and multiple representation of an important concept to be learned.
Carrying out the rotation	•Used orientation, groupwork, wrap-up cycle •Low facilitation •Use wrap-ups strategically		Operationalizes the strengths of a rich curriculum. Gives strucdture to relevant places for teacher input and leverage as the learning proceeds. Forces groups to be accountable in a supportive climate.
Status Treatments	•Post and discuss the multiple abilities needed to do the tasks well. •Add to multiple ability list with kids before each rotation. •Assign competence to low status students; consider using all three phases of lesson to do so. •Distribute assignment of competence to high status students as well.		Establishes mixed expectations for competence. Sets a norm that many abilities are necessary to do this work well. Pointing out that lower status students have skills that can help the group achieve its goal. Necessary to support the whole class in its efforts. Don't want to expose only the

			"target" students.
Assessment	•Pre/post		Content acquisition occurs.
	•Personal reflection		Learning student perception can help in future planning and design/redesign of tasks.
	•Ongoing tweaking/adjustment		Need to keep the rotation working as you go along.

Other Comments: