Co-design of Interdisciplinary Projects as a Mechanism for School Capacity and Teacher Professional Community Growth

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Abstract: This paper examines the use of *interdisciplinary project co-design*, as a mechanism for increasing the capacity of a school, and promoting the growth of teachers' professional practice in an urban high school setting. Changing teaching practices and the professional culture within a school can be extremely difficult. Simply providing resources about novel strategies can be ineffective. In fact, in some school cultures, suggestions for classroom practice change can be received with hostility, being viewed by some teachers as acts questioning their professional competence. This study describes how a strategically chosen task, interdisciplinary project co-design, was used by external consultants as a productive, non-threatening mechanism for instructional improvement, by simultaneously enhancing classroom practices and cultivating the growth of professional school community and organizational practices.

Introduction

When an organization faces a problem that it feels will require external help to solve, consultants, who are thought to have extra expertise, are often hired. Schools, in the face of policy demands beyond their traditional capacities, seek consultants to aid in implementations of reforms (Honig, 2004).

Consultants though are not simply repairmen, like electricians or plumbers, who are hired and rehired as necessary, to do some task for the organization. A consultant's role is more complex, and involves not only the solving of the problem, but of helping the organization somehow learn to deal with the problem more independently. Fullan (2001) concludes that consultancy is more generally about "building capacity, motivation, and commitment to engage in improvements".

Schools are especially difficult settings for consultants to be helpful because of the complex dynamics of some of the aspects schooling including their culture, and their interdependent organizational context. For example, in some schools, the culture may be such that the offering of help can be received with hostility instead of gratitude (Rosenholtz, 1989). In other schools, there are so many initiatives in place, that one consultant's efforts may conflict with another's—instructional coherence is a challenge identified by many studies including Newman et. al. (2001). It is not enough to have good ideas for solving a particular problem. A consultant must have a solid plan for how to share and implement the good ideas for a particular setting. In a school environment, Fullan (2001) calls these a *theory of pedagogy* and a *theory of change*. "A theory of pedagogy focuses on assumptions about learning, instruction, and performance; a theory of [change] tends to local context such as the conditions under which the model will work." Referring to Stokes, Sato, McLaughlin, and Talbert (1997), Fullan finds evidence that consultants focusing on both a theory of pedagogy and theory of change, were more likely to be successful.

This paper is a case study of *theory of change*, using the *co-design of interdisciplinary projects*, as a mechanism for school capacity and teacher professional community growth. It explains why the approach is useful, and the conditions under which it is most effective. This paper adds to the literature on effective school consultancy, by providing a practical case description, and by attempting to provide a helpful analytic lens for choosing an effective "theory of pedagogy and theory of change" pairing. The proximal goal of the work we present here is to contribute to a conversation that illuminates why particular forms of co-design activities gain a foothold in schools and seem to contribute to improvement and others do not.

Theoretical Background and Setting

We will rely on three constructs – Professional Community, Project-based Learning, and Collaborative Design – to guide this analysis of the role of co-design activities in improvement. Our treatment opens with a discussion of professional community and its relationship to local capacity.

Professional Communities of Practice

The importance of a strong professional teaching community for school reform is emphasized by many. Kruse, Louis, & Bryk (1995) observed that teachers in strong professional communities were more likely to feel a sense of empowerment. McLaughlin & Talbert (2001) claim that professional communities provide

opportunities for innovation and improvement of practice. McLaughlin and Mitra (2000) identify a supportive community of practice as one of five key components of their theory for helping reforms go deeper.

Lave and Wenger (1991) coined the term "community of practice" to describe a group of people who share a common interest in a topic or area, and work together to accomplish something. Communities of practice can be very large or very small. Their impact and allure depend on the goals of the group, and on what members get to do as participants.

Promoting the growth of a school's professional teacher community is an excellent strategic goal in and of itself, and also leads very directly to the growth of the capacity of the school as an organization.

Project-based Learning

Project-based Learning (PBL) is an instructional approach that organizes learning around the doing of projects. PBL's roots are attributed to many sources including Dewey (Markam, 2003) and the "Problem-Based Learning" model developed for use with medical students (Thomas, 2000)

The benefits of PBL are thought to be many. For example, there are claims of increased student motivation and engagement as a result of PBL (Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palincsar, 1991) and of increased student achievement in science (Tal, Krajcik, & Blumenfeld, 2006) and mathematics (Boaler, 1999). The application of knowledge to real-world contexts and self-direction required of students, are thought to have cognitive benefits including better recall and improved problem solving abilities (Brown & Campione, 1996, Boaler, 1999; Thomas, 2000).

Interdisciplinary projects are an attempt to design projects that involve more than one content area. For example, math and science may collaborate on a project, or English and Social studies on another. Interdisciplinary projects often require a greater degree of planning and coordination, but have the advantage of helping students see how different subject areas are related.

Collaborative Design

There has long been a regrettable disconnect between the activity of those researching teaching and learning and those doing teaching and learning in classrooms. There has been an attempt to bridge this disconnect in the form of design based research (Brown, 1992; Collins, 1992). Collaborative design research (Shrader et al, 2001, D'Amico, 2005) seeks to involve teachers and other school staff in the design process. It allows researchers and stakeholders to co-construct the implementation of the reform (Datnow, Hubbard and Mehan, 1998). This is in contrast to the traditional top-down approach to reform and professional development delivery.

Through collaboration, the expertise of the various members of the design team are equally valued and members learn from one another through their interactions. By involving the 'end users' in the design, consultants also try to ensure the use and utility of the products they design (Muller & Kuhn, 1993). This is especially important since other studies warn that the level of adoption of classroom interventions (or innovations) is influenced by the teachers' interpretations of their classrooms (Cohen & Hill, 2001).

Bootstrap Model for Organizational Improvement

Engelbart (1962, 1992) identifies three levels for categorizing the activities of an organization. An organization's primary activity, is its "A-level" activity. For a steel mill, producing steel is one of its "A" activities. For a school, "teaching students math" and "teaching students reading" are examples of "A" activities.

Activities that are concerned with improving the organization's ability to perform A-level functions, are considered "B-level" activities. Strong organizations make investments in B activities, because even while taking resources away from A activities initially, the strong rate of return (through improved A-level work) make B-level resource investments worthwhile. In a school, "teacher meetings for developing new math teaching strategies" are an example of a B-level activity. They have a direct impact on the A-level activity "teaching math".

Engelbart suggests that the most effective organizations, also invest in activities to "improve their ability to improve". He calls these C-level activities, and they are concerned with improving B-level activities. Figure 1 depicts these relationships. In a school, a committee charged with organizing and evaluating teacher meeting schedules to optimize the mix of teacher meeting activities, would be an example of a C activity. This C activity committee can have a direct impact on B activities like the frequency of "teacher meetings for developing new math strategies".

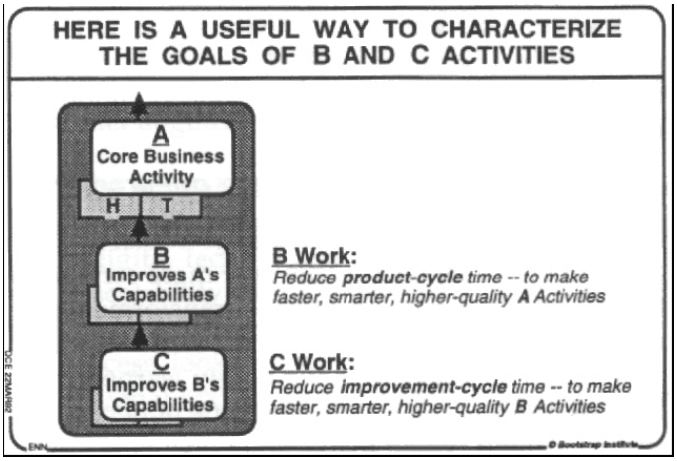

Figure 1. Introducing "C" level activity to improve the ability to improve (Engelbart, 1962).

Engelbart uses the metaphor of bootstrapping to describe C-level activities. Investment in C-level work provides the most potential impact. The right investments in C-level work will be multiplied in returns in increased B-level work, the ability to improve. This impact on B will be multiplied again in returns in productivity in the organization's core level work. It is a way of getting better at getting better, a kind of "compound return on investment in innovation." (Engelbart, 2003)

Setting

MidCity High School serves approximately 2100 students in a large Midwestern U.S. city. Approximately 85% of the student body is considered low-income, with 77% qualifying for free lunch, and 86% qualifying for reduced price lunch. Approximately 81% of the student population is Hispanic; 15% African-American; 2.5% Caucasian; and 1.5% Asian.

The principal of MidCity realized that the diverse and often challenging teaching situations facing her teachers and students, was not well served by the organization of her school as a large comprehensive high school. A teacher who wanted to introduce an improvement would sometimes be overwhelmed by the effort needed to influence such a large student and teacher population.

The principal wanted her teachers to be able to coordinate academic and social support efforts with other teachers, and to adapt their instruction to flexibly meet the needs of individual students. To this end, she initiated the conversion of her school to a consortium of small schools or small learning communities (SLC), where a group of four core subject area teachers (English, math, science, and social studies) would share the same group of approximately 100 students. Cotton (2001) identifies numerous benefits of SLCs including the opportunity to personalize support and instruction for a manageable number of students, with a tractable number of fellow teachers.

Our group was hired as an external consultant to assist with the conversion, and to help teachers take advantage of the instructional opportunities presented by the SLC structure.

Consultant Activities

Theories of Pedagogy and Change

A supportive principal was in place and the school structure was moving in a helpful direction. However, general teacher resistance to change (for various reasons) was still present. All teachers possessed certain teaching practice skills, preferences, and beliefs. When faced with low student achievement, some teachers would insist their methods were fine, and that the students' response to the instruction was flawed. Others wanted to adapt their instruction, but found the effort to be overwhelmingly difficult, and so continued with instructional practices they already knew. Pockets of successful adaptation did exist, but were scattered.

The principal wanted the *school as a whole* to become better at adapting and modifying instruction to meet the varied needs of the current population of students. (She wanted success to be experienced by *all students and teachers*, not by just a select few who happened to have certain especially successful teachers.)

Our task was to help promote instructional adaptation and innovation, to meet the needs of a challenging student population. Repeating Fullan's words, as consultants, we would need to "[build] capacity, motivation, and commitment to engage in improvements". We felt that it would be best to attempt this by concentrating on both (a) a few core instructional issues and (b) the professional teacher community.

One of our core *theories of pedagogy* was project-based instruction. We felt the instructional potential of project-based learning was significant and well suited for this population. Our *theory of change* was to engage teachers in the co-design of interdisciplinary projects (IDP) with high levels of design and

implementation support—as opposed to giving teachers pre-designed single-subject projects and materials. We felt this pairing would work for the following reasons:

- IDPs could be used to address many core instructional needs. IDPs are not limited to any one particular domain or grade level.
- IDP design provided a forum for teachers and consultants to work together on a task where all parties could contribute significantly and learn from each other.
- IDPs required the cooperation of teachers across disciplines for both planning and implementation, thereby helping promote a more active community around instructional issue discussion—as opposed to the more common active community of complaining about student shortcomings (Rosenholtz, 1989).
- Successful IDP co-design experiences, would help teachers build expertise and confidence with project design and implementation. This would hopefully give them a starting point for designing single-discipline projects, which at least logistically, would be easier than IDPs.

Co-Design of Interdisciplinary Projects

The co-design of projects involved our support during both the planning and implementation phases. Planning support activities were varied and included help with the following:

- Establishing learning goals
- Choosing a final product
- Constructing a project calendar
- Creating rubrics
- Creating new lesson materials
- Planning how to group students

Initially, we organized and led teacher project planning meetings over the summer and during the school year. In subsequent years, teachers took responsibility for meeting organization and leadership, and we served as active meeting participants. It is important to understand that these consultant activities unfold in multiple ways. For example, consultants sometimes essentially "do the work". At other times, consultants work in a co-design arrangement with teachers and others.

Support during implementation included co-teaching, modeling, and co-assessing. The implementation was also a part of the design process because our involvement promoted reflection. Our presence permitted two kinds of reflection: reflection-in-action and reflection-on-action (Schon, 1983). The reflection-in-action took place when teachers talked to us about how the work was going as the work was going. For example, immediately after leading a class activity and observing how students responded, a teacher might tell us that they are going to do it differently the very next period. The reflection-on-action is the debriefing that took place during the off-periods and before/after school. This was time where we looked back on what had transpired as well as considering what needed to take place the next day.

Three representative project examples are described below, and discussed in greater detail in the results section of this paper. Of the over 30 projects that could have been described, these three represent three points along a broad spectrum of project outcomes. One is an example of a very successful project, another an unsuccessful project, and the third has elements of success along with noteworthy challenges.

An important goal for this work and this paper, is to begin to have a framework for helping us understand why some projects seem to be successful and others seem to not gain traction in a school. The projects that were picked were done so to provide contrastive cases for developing and testing the framework.

Sustainable Earth

One of the first co-designed interdisciplinary projects was the "Sustainable Earth" Project by the Math Science and Technology Academy (MSTA) SLC. After much discussion about teaching approaches, key content, and alignment between subject areas on the school calendar, an existing Global Warming unit for middle school children, was adapted by the teachers and consultants for ninth graders with more population content. All four subject area teachers had some role, with science and social studies teachers taking the lead. Co-design activities started in the summer over a focused period of a week, and continued intermittently through the school year. Implementation was targeted for the end of the second semester.

The project seemed to have the intended effect, with teachers noticing that students worked diligently on their projects right up until the last days of school. This was in contrast to the drop in student engagement typically seen the last few weeks of school. Student performance during the culminating "Earth Summit" and their responses to surveys, suggested high student engagement and learning.

After the initial positive experience, the project went through four design iterations with a shift in instructional emphasis moving from presentation as the culminating product to a debate. Consultants helped teachers with the redesign and implementation efforts of each. Teachers also noted the need for more common

planning time (or more strategic use of existing time) and requested meeting time with just their grade level cadre of teachers separate from the rest of their small school.

Cookies and Culture Project

The Cookies and Culture project was an attempt by the internationally themed small school to create an interdisciplinary project. The social studies, culinary arts, and foreign language teachers were involved in the planning and implementation. The teacher-chosen plan was to consider the manufacturing, marketing and cultural differences related to cookies. One teacher even planned to involve a local food pantry as an element of service learning.

Although we tried to push the collaborative effort at meetings, there is no evidence that the social studies or service learning components that the teachers had planned ever came to pass. The observed final product was the baking and selling of cookies at an event celebrating of world cultures.

Car Crash Project

A Car Crash Project involved the science and math teachers in the Journalism, Communications, and Law Academy (JCLA) SLC. Students analyzed "evidence" in the form of velocity-time graph logs and eyewitness accounts to determine the driver at fault. They then presented their findings in the form of a news broadcast, docu-drama, or closing statement of a trial, using the data analysis they had prepared. Teachers did most of the conceptualization, planning, and implementation, including an elaborate video introduction using iMovie. They arranged extra meeting times outside of small school meetings to complete their planning. In design meetings, consultants helped bridge the math and science content to create a key series of sensible scenario designs that would fit the analytic content goals of the project. Teachers were pleased with the design and seemed to implement the project successfully without a lot of implementation support from consultants.

Methodology

There were several sources of data for this work, collected by six researchers (four at a time) over the course of seven years.

- Meeting agendas, minutes, and notes
- Classroom observation notes
- Teacher interviews
- Administrator interviews
- Project-based instructional unit descriptions and numbers
- Teacher and Student surveys

Researchers were a regular part of the school community, present at the school to participate in meetings, help in classes, and participate in regular school activities approximately four days a week for 40 weeks during the school year. In addition, researchers organized week-long summer professional development sessions for teachers for six straight summers.

For this paper, notes and interviews related to particular projects were used to inform our analysis of the sequence of project planning and implementation activities and allowed us to reconstruct what went on in classrooms and design meetings with teachers. Student surveys, teacher surveys, teacher interviews, and observations were used to inform a holistic sense of how successful A-level activities were. For this analysis we (in co-present and individual coding discussions) considered data from each of our data sources. In the coding meetings we first identified segments of notes (meeting, observation) and interviews, which appeared to be representative of A, B, or C level activities for each of the co-designed projects. Next, through constant comparative analysis, we subjected each A, B, or C level grouping to within group analysis to confirm that the elements of the category were representative. After the data and comparison was exhausted, we determined our final analytic corpus which will be illustrated.

Results and Discussion

We attempt to briefly report the planning and implementation outcomes of four co-design efforts through Tables 1 and 2 below; three are projects and one is a non-project activity. While much more can be said of each category, for quick comparison purposes, a summative single "score" is assigned to each category for each project on a scale of zero to four, with four being the highest possible positive score. The scores were determined after a discussion of merits by the authors.

For example, B-level activity ratings follow a simple rubric, where a "0" corresponds to "no observed B-level activities", a "1" corresponds to "as least one or two observed instances of B-level activities", a "2" corresponds to "at least three to five observed instances of B-level activities", and so forth. A-level activity goal ratings (that is, assessing the quality of proposed student learning goals) follow a rubric where a "0" corresponds to "learning goals not connected to state or local content learning standards, a "1" corresponds to "learning goals

address approximately 0%-25% of class content learning standards during duration of project for that period of time in class", a "2" corresponds to " learning goals address approximately 25%-50% of class content learning standards during duration of project for that period of time in class ", and so forth.

Table 1: Activity Co-Design Summative Report of Teacher Activity.

	Sustainable Earth Project	Cookies and Cultures Project	Car Crash Project	College Awareness and Interest Activities
A Level Activities	Activity Learning Goals: **4** Implementation Impact on Student Learning: **4**	Activity Learning Goals: **2** Implementation Impact on Student Learning: **1**	Activity Learning Goals: **4** Implementation Impact on Student Learning: **4**	Activity Learning Goals: **4** Implementation Impact on Student Learning: **4**
B Level Activities	**4**	**2**	**4**	**1**
C Level Activities	**3**	**0**	**2**	**0**
Areas where school organization appeared to need the most help	A: Implementation, B C	A: Goal setting	B	A: Implementation, B

Table 2: Activity Co-Design Summative Report of Consultant Activity.

	Sustainable Earth Project	Cookies and Cultures Project	Car Crash Project	College Awareness and Interest Activities
A Level Support	Activity Learning Goal Support: **4** Implementation Support: **4**	Activity Learning Goal Support: **1** Implementation Support: **0**	Activity Learning Goal Support: **0** Implementation Support: **0**	Activity Learning Goal Support: **2** Implementation Support: **4**
B Level Support	**4**	**0**	**3**	**4**
C Level Support	**3**	**0**	**0**	**0**

Consultant Co-design vs. No Co-design

Comparing the Sustainable Earth and Cookies and Cultures Projects, both had the same (a) interdisciplinary project goal, (b) summer planning time and opportunities, and (c) project planning templates. However, even though it was offered, the Cookie project group did not seek co-design participation with consultants, while Sustainable Earth project groups repeatedly sought co-design help. It seems that partly as a result, the Cookies and Cultures Project, while having a promising start, ended up having less academically rigorous properties. In the case of the Sustainable Earth project, the advice seeking behavior (i.e., asking consultants specifically about what to do in classroom enactment) led to concrete A-level implementation suggestions that made their way into project enactment. The results of the enactment in turn provided a common ground for B-level discussions about project improvement and instruction among teachers and consultants.

Targeted Need Assistance vs. Need Unassisted

The Car Crash project example, also had the same (a) interdisciplinary project goal, (b) summer planning time and opportunities, and (c) project planning templates as the other two. Similar to the Cookie case, goal establishment help was not received from consultants, but the key need here was activity planning assistance, which actually was provided. The key Cookie Project need at the project goal establishment level, was not met by consultants through co-design activities, while the key need for the Car Crash Project was met.

Projects vs. Non-Project Co-Design Activities

Co-design of interdisciplinary projects was not the only consultant activity. Our work extended to school activities beyond those that that had their start in classroom work. For example, we also attempted to address with the school, the co-design of activities to increase student awareness and interest in college (Column 4 of Tables 1 & 2). Activities that were designed and implemented included early visits to college campuses beginning at the 9th grade, and more interactive college fairs at the high school.

Here the A-level results were strong, with very positive outcomes reported by students. However, teachers did not contribute as much to the design (B activities). Teachers, all college educated, reported they

saw the consultants as possessing more expertise around how to build college awareness and interest. It is clear though, that teachers recognized that the task was important. They took part in repeated college visits at the upper grade levels where they used the set of routines created by consultants with little modification. However, as framed, the college problem did not seem rich enough to give rise to B or C issues, and no major revision of college readiness activities were proposed.

B-Level and C-Level Activities

Considering all four examples, three had successful A-level activities, but only the two with strong B and C activities led to additional productive A and B level outcomes. Both Car Crash and Sustainable Earth projects had stronger teacher community and classroom instruction outcomes. The Cookies Project, and College Awareness projects failed to provide a setting where teachers sought, and consultants provided, design advice. They therefore, were very weak in B-level activity and did not progress beyond what was initially designed.

Teacher community growth and individual teacher capacity growth, were also apparent through another measure. The small schools with the teachers from the successful projects with B and C activity participation, also designed and implemented a much larger number of single and inter-disciplinary projects on their own in subsequent semesters. Table 3 shows a three-year snapshot of visible projects. We conclude that those communities that had opportunities for reflective discussion (levels B and C) developed the capacity to engage in design and planning with less intervention from consulting staff. We suspect that our results show that while A-level support is valuable in the short term, deepening practice depends on opportunities for reflection.

Table 3: Number of Visible Projects by Small School.

Year	MSTA Projects	JCLA Projects	Internationally Themed Small School Projects
2005-2006	10	13	2
2004-2005	8	10	1
2003-2004	7	1	0

Conclusions

Fullan's (2001) consultancy observations suggest the importance of consultants having both a strong *theory of pedagogy* and strong *theory of change*. Based on the literature and our experience with consultancy, project based instruction was chosen as our key theory of pedagogy, and collaborative design of interdisciplinary projects was chosen as our theory of change. The results of our work at MidCity High School with this pairing suggest the following lessons:

- Consultants need to select rich tasks with the potential to influence the community at many levels (A, B, and C). "Rich tasks" are those that both (a) address key needs and (b) create other needs. The interdisciplinary projects design task provided this for the school while college awareness design task did not.
- It is not enough that the A-level implementation is a highly successful experience for students and teachers. Teachers must be integrally involved in planning and preparation (B-level activities). Teachers can be encouraged to participate by choosing tasks where both teachers and consultants can contribute significantly. Interdisciplinary projects provided this.
- Support must be provided to overcome key barriers at any level to help groups enjoy initial project co-design success. This was provided with the Car Crash project (though at only one level), but not with the Cookie and Cultures project — an attempt to provide support was made with the Cookies project, but perhaps not vigorously enough. Comprehensive support was provided at many levels for the Sustainable Earth project, which seemed to lead to the experience of implementation success of projects with academically rigorous goals.
- A successfully supported co-design experience helped promote the growth of the professional teacher community, and appeared to lead to many future collaborations.

Finally, it seems analyzing a consultant's theory of pedagogy and theory of change pairings with Engelbart's ABC framework, can help account for outcome success and suggest changes to improve consultant activities. Pairings that promote activities at both the B and C levels are more likely to produce lasting teacher professional community and school capacity growth outcomes.

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Acknowledgements

The authors thank the Aon Foundation for their support of the work reported here. We thank Ken Rose, Margie Pligge, Martin Block, Ann McKenna, and Claudia Hindo, for their numerous contributions to the actual work at MidCity High School. We also thank Kim Gomez for comments on an earlier version of this paper.