Research on the effects of team teaching upon two secondary school teachers

Syh-Jong Jang*
Chung-Yuan Christian University, Taiwan

Background
The implementation of the nine-year integrated curriculum in the primary and secondary schools of Taiwan represented, in practice, a great change to the nature of school teaching. This was mainly due to the fact that the new scheme for the curriculum required teachers to collaborate with one another, when they had been teaching students independently for most of their teaching career.

Purpose
The purpose of this research was to study the effects of team teaching upon two 8th-grade teachers in the field of mathematics. The specific research question was student performance and teacher perceptions concerning team teaching.

Programme description
Team teaching involves two or more teachers whose primary concern is the sharing of teaching experiences in the classroom, and co-generative dialoguing with each other. They take collective responsibility for maximizing learning to teach, or becoming better at teaching, while providing enhanced opportunities for their students to learn.

Sample
The subjects of this experiment were chosen from the 8th-graders of a secondary school in Taoyuan County, Taiwan. Two certified maths teachers and four classes participated in this study. One each of the teachers’ two classes was selected to be the experimental group (63 pupils), and the remaining two classes (61 pupils) were the control group. The students’ original placement was performed by the school according to a normal ‘S’ distribution.

Design and methods
The researcher made use of a quasi-experimental method, assigning the four sampled classes to experimental group and control group. This study was a two-stage team teaching experiment, dividing the 12-week period into two equal halves. The main research method was a combination of quantitative and qualitative analysis. The research data included student scores, questionnaires, teachers’ self-reflection, video taped records of teaching performances and the researcher’s interviews with teachers.

Results
The research findings showed that the average final exam scores of students receiving team teaching were higher than those of students receiving traditional teaching. The two teaching methods showed significant difference in respect of students’ achievement. More than half of the experimental students preferred team teaching to traditional teaching. The discrepancy between team teachers’ expectations of team teaching and its implementation was apparent. The differences in the teaching strategy also exposed team teachers to challenge and being compared with each other by students in class. Besides, the team teachers had been unprepared for this comparison, especially in regard to class management. The implementation of team teaching, however, did not win the support of the...
school administration, which impeded teachers in holding team meetings and caused students doubts regarding team teaching.

Conclusions
Since the research concentrated on a single subject, the implementation of team teaching in the field of interdisciplinary courses is needed. The key to this lies with teachers, who are required to do this actively; otherwise, educational reform will not achieve its goals.

Keywords: Team teaching; Co-teaching; Cooperative teaching; Collaboration; Teaching innovation; Mathematics

Introduction
A nine-year integrated curriculum scheme was implemented in Taiwan’s primary and secondary schools in 2001. The nine-year integrated curriculum covers a 1st-grade to 9th-grade continuous curriculum integrated from traditional courses into seven learning fields (Taiwan, Ministry of Education, 1998). The curriculum for each subject was transferred to the field of interdisciplinary courses, and individualistic teaching methods accordingly transformed into team teaching (Jang, 2001). As a result, the implementation of the nine-year integrated curriculum comprised a great change, differing greatly from the existing teaching culture in both primary and secondary schools in Taiwan.

Collaboration is increasingly identified as a key aspect in teachers’ professional growth. Educational reformers have recommended placing more attention on the collegial relations of teachers for the purposes of professional growth (Little, 1993; Lieberman, 1995). Effective professional growth must be collaborative, involving the sharing of knowledge among teacher communities of practice rather than concerning individual teachers (Darling-Hammond & McLaughlin, 1995; Firestone & Rosenblum, 1998; Roth et al., 2002). Researchers report that regular opportunities for interaction with colleagues are essential in creating professional school cultures (Lieberman et al., 1988; Miller, 1988). A community of peers is important not only in terms of support, but also as a crucial source of generating ideas and criticism (Sykes, 1996).

Little (1990) examined prominent forms of collegial relations—assistance, sharing and joint work. Joint work is a strong version of collegiality that shifts teaching from the individualistic to the collective, breaking down the barriers of privacy and leading towards new kinds of teaching (Abell, 2000). Professional development activities must provide regular and frequent opportunities for both individual and collegial reflection on classroom and institutional practice (National Research Council, 1996).

However, it needs to be asked why collaboration has been largely ignored in schools? First, in many schools, opportunities for collaboration among teachers are limited and communication tends to be informal and infrequent, even though teachers believe their teaching could be improved by working with colleagues (Little, 1990; Corcoran, 1998). Second, the dominant school structure continues to emphasize teacher autonomy rather than collaboration; for many years, schools have expected teachers to
teach students independently without assistance from others (Lortie, 1975). The practice of this pattern has hindered attempts to create collaborative environments where teachers regularly talk with each other, and observe one another. Third, collaboration is not necessarily easy in the form of team teaching: it takes time and energy for teachers to work together in planning, teaching and evaluating.

A related approach to increased collaboration among teachers exists in team teaching. Team teaching is, in fact, a typical element of primary school level education (Golner & Powell, 1992; Williamson, 1993), but has less frequently been implemented at the secondary school level. Perhaps this is due to traditional departmental barriers (McKenna, 1989) that have often made collaborative teaching difficult, or even impossible. Snyder (1992) stated that collaboration is, indeed, a problematic relationship, which is also about collegiality and professional sharing; similarly, Lytle and Fecho (1991) observed that collaborative cultures take time to develop, require trust and mutual understanding, and are derived from day-to-day interaction as well as long-term relationships of participants. In school restructuring, teacher isolation has been identified as the most powerful impediment to implementing reform (Lieberman, 1995); and little change will indeed occur in schools unless teachers constantly observe, help and interact with one another (Barth, 1990).

The purpose and research question

Research has shown that team teaching is an effective way of constructing deep learning of concepts while learning alternative ways to teach the same subject-matter. Developing co-generative dialoguing occurs to further develop existing understandings of the teaching situation (Tobin et al., 2001; Roth et al., 2002). Team teachers also create material and social resources that allow subsequently for new forms of agency (Roth et al., 2004, 2005).

The main purpose of this research was to study the effects of team teaching upon two 8th-grade teachers whose field was mathematics. The specific research questions related to student performance and teacher perceptions concerning team teaching. This study chose the implementation of team teaching in the field of mathematics, because mathematics was seen as a single subject, uncomplicated by interdisciplinary courses (such as the natural or social sciences). Nor did it require any major rearrangement of the school courses; the advantage of this was that the researcher was able to concentrate on discussing student responses and mutual interactions of the two teachers concerned.

Rationale

Welch et al. (1995, 1999) noted that teaching terminologies of collaboration are often exchanged and used synonymously. For example, terms like co-teaching (Cook & Friend, 1996; Walther-Thomas et al., 1996; Roth & Tobin, 2001), cooperative teaching (Bauwen & Hourcade, 1995) and team teaching (Welch & Sheridan, 1995; Sandholtz, 2000) refer to a similar instructional delivery system. Cook and Friend (1996) identified four key components of co-teaching: (1) two educators, (2) delivery
of meaningful instruction, (3) diverse groups of students and (4) common settings. Team teaching has a variety of operational definitions. For example, the term may refer to (a) a simple allocation of responsibilities between two teachers, (b) team planning but with individual instruction or (c) cooperative planning, instruction and evaluation of learning experiences (Sandholtz, 2000). These varying operational definitions of team teaching result in varying amounts of collaboration among teachers. Clearly not all team teaching approaches offer equivalent opportunities to foster collaboration and enhance teachers’ professional development.

Co-teaching involves two or more teachers whose primary concern is the sharing of teaching experiences in the classroom, and co-generative dialoguing with each other. They take collective responsibility for maximizing learning to teach or becoming better at teaching while providing enhanced opportunities for their students to learn (Tobin et al., 2001; Roth et al., 2002; Roth & Tobin, 2002). Co-teaching provides us with a zone of proximal development, the interaction between individuals and a new form of societal activity. The central purpose of co-generative dialoguing is to further develop the existing understanding of the teaching situation in order to increase professional growth. Roth et al. (2002) considered co-teaching as an effective means of achieving deep learning of science concepts while learning alternative ways to teach the same subject-matter.

Co-teaching also provides opportunities for new teachers to obtain greater opportunities of learning to teach (Roth et al., 2004). The presence of co-teachers increases access to social and material resources—thereby increasing opportunities for actions that would not otherwise occur. In whole-class situations, the coordination and reciprocity of the teachers’ actions are crucial where the potential arises for miscues and non-complementary actions to occur (Tobin et al., 2003). Because co-teachers teach together, interactions continuously occur; thus the actions of any of the participants in the new classroom structure in the field are resources that provide ample opportunities for others’ action. Co-teachers continuously create material and social resources that allow for new forms of subsequent agency. Such resources include physical, social spaces and meaning-making entities: co-teachers take advantage of these resources in synchronized and coordinated ways (Roth et al., 2005).

Social constructivists emphasize that the notion of intersubjectivity is highly important. Intersubjectivity allows the meeting of two minds, with each operating on the other’s ideas, ‘using the back-and-forth of discussion to advance his or her own development’ (Rogoff, 1990, p. 149). It also allows for joint thinking, problem-solving and decision-making processes from which the learner appropriates new knowledge (Newman et al., 1989). No one person construes the stream of events in the same way as others; as they interact with one another, they develop ideas that, because they are held in common, create a universe of discourse, a common frame of reference in which communication can take place (Solomon, 1987; Connolly & Smith, 2002). Knowledge is collaboratively constructed between individuals from where it can be appropriated by each individual (Vygotsky, 1978). Team teaching gives teachers the opportunities to act on their ideas and reflect in and upon their actions. Their understandings evolve through a meaning negotiation process, in which they discuss their own ideas and consider the ideas of others (Bayer, 1990).
Bennett et al. (1992) state that: (1) collaboration can only be effective when there is a genuinely equal relationship between all parties; (2) differing knowledge bases, including theoretical knowledge and practical knowledge, must be of equal importance; (3) both parties must commit to engaging in ongoing dialogue and mutual inquiry; (4) all participants must have opportunities to experience others’ reality in a mutually supportive environment; and (5) collaborators must be able to openly discuss any issues or problems that arise. In addition, Bennett et al. (1992) suggest that the following three characteristics are essential for effective partnerships: a degree of dissimilarity between the partners, the mutual satisfaction of self-interest and a measure of selflessness on the part of each partner, while assuring their satisfaction of self-interest in the partnership.

The forms of co-teaching

Cook and Friend (1996) described five forms of variations in co-teaching: (1) one teaching/one assisting: a technique in which one teacher takes an instructional lead while the other assists students when necessary; (2) station teaching: dividing the class content and room arrangement, with each teacher working on a specified part of the curriculum and classroom, so that students rotate from one station to the other; (3) parallel teaching: both teachers plan the instruction but divide the class into two halves, each taking responsibility for working with one half of the class; (4) alternative teaching: organizing a classroom into one large group and one small group, where one teacher is able to provide main instruction, the other to review a smaller group of students; and (5) team teaching: teachers take turns in leading discussions or both playing roles in demonstrations.

Again, Sandholtz (2000) compared four approaches of team teaching implemented in a collaborative teacher education partnership at a university. Over a five-year period, the partnership experimented with varying methods of team teaching at the high school level. He described the partnership’s decision-making process, documented the four approaches to team teaching, discussing benefits and drawbacks, and identified key areas to consider in designing team teaching components aimed at fostering professional development. However, the basic definition remained constant: joint planning, joint instruction and joint evaluation. The initial aim in developing and implementing a team teaching component was to enhance the professional growth of student teachers. Therefore, the primary goals of the team teaching component were directly related to student teachers’ professional development: (1) to increase collaboration; (2) to encourage experimentation with new teaching strategies; (3) to enable observation of colleagues in a natural setting; and (4) to foster collegial analysis of instruction.

Research design and methodology

This study used a mixed-method design, incorporating both quantitative and qualitative techniques. Quantitative analyses were employed to investigate the hypothesized relationships between team teaching experience and student performance. Qualitative
data comprised a combination of documentary interpretation (Erickson, 1986) and qualitative analysis (Strauss, 1987). This research adopted the data processing and analysis suggested by Patton (1990), which comprised two aspects: the organization of data and documentary interpretation. The data were at first collected and coded, then organized into categories. The data were interpreted on the basis of these categories; the main data included students’ scores, questionnaires, teachers’ self-reflection, video taped records of teaching performances and the researcher’s interviews with the teachers.

Participants

The subjects of this experiment were chosen from the 8th-graders of a secondary school in Taoyuan County, Taiwan. Four classes were selected out of 27 classes in the 8th grade. To minimize any ineffective communication, the researcher began by seeking a teacher with whom he could communicate effectively to participate in the study on team teaching. Next, that teacher was required to find another teacher with whom she could also communicate effectively in order to be a team partner. Two certified maths teachers, Mary and Amy, each taught two of the chosen classes. Both teachers held undergraduate degrees in mathematics. Mary had one year of teaching experience; whereas Amy had five. Mary had a mild personality and seldom lost her temper in class, while Amy was more forthright, one who called a spade a spade and rarely ‘loosened up’ in class. One of each of the teachers’ two classes was selected to be the experimental group (E1, E2); the remaining two classes were the control group (C1, C2). Because the researcher was restricted by the original class placement, the method of choosing subjects was that of non-random sampling. However, the students’ original placement was performed by the school, according to a normal ‘S’ distribution. To ensure that the maths grades of the experimental group were consistent with those of the control group prior to the experiment, the researcher conducted a t-test of the two groups’ grades taken from the 8th-graders’ first mid-term exam (pre-test). The average scores of the four classes—E1, E2, C1 and C2—were 70.68, 70.34, 70.10 and 71.16. The scores did not show significant difference ($t = 0.25, p > 0.05$). The researcher further divided the students into higher-achieving and lower-achieving students based on their first mid-term exam scores. The cut-off score was 70. The numbers of higher and lower achieving students in each of the groups are presented in Table 1.

Procedures of implementation

The researcher made use of a quasi-experimental method, assigning the four sampled classes to the experimental group (E1 and E2) and the control group (C1 and C2). The experimental group was taught by team teaching, while the control group received the traditional teaching method. Before the research, the four classes received a pre-test (the first mid-term exam); the post-test was based on the 8th-graders’ final exam results. The experiment lasted for 12 weeks. Prior to the experiment, the researcher discussed the five co-teaching models with the two teachers, as proposed by Cook and
Friend (1996). Following the discussion, the researcher took into consideration the following factors: current teaching practice adopted in Taiwan’s classrooms; classroom size; teachers’ workload; and students’ maths learning ability. At this point, the school did not have classrooms that could accommodate two classes at the same time. In addition, maths was taught to students who were divided according to their ability. The researcher did not wish to increase the teaching hours of the teachers who collaborated in the team teaching experiment; therefore, the researcher decided to revise Cook and Friend’s (1996) co-teaching model. Both teachers would work together in the planning of the syllabus, preparation and the carrying out of teaching, and participate in the after-class discussion. Ideally, the researcher hoped that the collaborating teachers would share the same classroom setting and teaching, each setting up a ‘station’ in the classroom and being responsible for one part of a divided lesson. Students would then rotate from one station to the other after completing one part of the lesson with one teacher. However, considering the fact that the school did not have classrooms sufficiently large to accommodate two classes at the same time, the researcher arranged E1 and E2 to have maths lessons during the same class periods. The higher-achieving students from E1 and E2 were then regrouped into a new class, and the lower-achieving students of both classes were regrouped into a second class. The researcher planned a two-stage team teaching experiment, dividing the 12 weeks into two equal halves. For the first three weeks of the experiment, Mary taught the higher-achieving students, while Amy taught the lower-achieving students. In the following three weeks, the two teachers switched groups. Having finished the first stage, the teachers switched to another form of team teaching in the next six weeks. The students returned to their original classes. The teachers cooperated in teaching the lessons, switching classes after finishing each class period. After 12 weeks of experiment, a survey was conducted, and students in the experimental group were asked for their opinions concerning their team teaching experience.

**Data collection**

1. *Tests*: the textbook used by the 8th-graders was Book 3 of *Secondary school mathematics*, published in Taiwan. Among the materials covered were ‘second
degree equations with one variable’ and ‘inequalities’. The pre-test (the first mid-term exam) and the post-test (the semester’s final exam) were school-wide uniform maths tests given to the students. The test was written by the school’s maths teachers. The final maths exam consisted of three parts: multiple choice; filling in blanks; and problems requiring students to write down the solving steps. The researcher and the two collaborative maths teachers evaluated the exam questions and found that they had satisfactory content validity and generally met the requirement of the teaching objectives.

2. **Teachers’ self-reflections**: team teachers made journal entries during or after team teaching throughout the semester. They often wrote down their reflections twice a week. The content of the journals included personal observations, impressions, feelings and analyses, and self-reflection and self-examinations concerning their team teaching performance, team meetings, and so on.

3. **Video taped records of team teaching performances**: in this research, all the team teachers’ teaching performances were video taped. The main purpose was to record all details of interaction between the teachers and students. The research team viewed the video tapes and produced feedback on their teaching performance.

4. **Questionnaires**: the main purpose of the questionnaires was to understand the students’ responses to the team teaching. This research planned the questions for the end-of-course questionnaires; the questions were open ended, including the following:
   - Do you think team teaching was superior to traditional teaching in this semester? Why? Please give some reasons or examples.
   - Do you think team teaching would affect your performance in the final examination? Why? Please give some reasons or examples.
   - How did you feel about team teachers being in charge of your classroom management?

5. **Interviews with team teachers**: this research adopted semi-structured interviews. According to Patton (1990), the advantages of semi-structured interviews are twofold: the main questions of the interviews can be listed beforehand, e.g. ‘What did you expect from team teaching prior to implementing it?’, ‘What was the main problem you had when implementing team teaching?'; and also, during the interviews, the interviewer is able to rearrange the listed questions according to the reactions of the interviewees, the atmosphere of the interview, etc. The researcher conducted these semi-structured interviews at the end of the semester with the team teachers.

**Data analysis**

The researcher employed the \( t \)-test to analyse the quantifiable data gathered during the study. The purpose was to discover whether team teaching had any impact on students’ final exam scores (post-test), and whether the difference in the scores of the students receiving team teaching and traditional teaching could reach levels of significance. Answers to the survey questions regarding team teaching were presented
The qualitative data included questionnaires, teachers’ self-reflection, video taped records of teaching performance and the researcher’s interviews with teachers; the research adopted the method of data processing and analysis suggested by Patton (1990), comprising coding and categorization of data for analysis.

**Results**

The results were divided into four parts: the researcher addressed the effects of team teaching on students’ final exam performance; the students’ attitudes towards team teaching; the perceptions of the collaborating maths teachers following their participation in the team teaching experiment; and derivative problems, such as classroom management and school administration, as related to team teaching.

**Students’ performance and responses after experiment**

The average final exam scores of students receiving team teaching were higher than those of students receiving traditional teaching. Table 2 presents the maths mean scores and standard deviation of both the pre-test and post-tests for the four classes. Both experimental groups’—E1 and E2—post-test mean scores were higher than the pre-test scores; while post-test mean scores were lower than the pre-experiment scores for both control groups—C1 and C2. In order to determine whether teaching methods were significantly related to the scores of the experimental group and the control group, a *t*-test was carried out to compare pre-test and post-test scores of E1 and E2. Both results showed significant difference (E1: $t = 3.87, p < 0.01$; E2: $t = 7.43, p < 0.01$). However, a *t*-test comparing pre-test and post-test scores for C1 and C2 showed no significant difference (C1: $t = 0.576, p > 0.05$; C2: $t = 1.408, p > 0.05$). A *t*-test was conducted to determine whether there was significant difference between teaching methods and the post-test scores of the higher- and lower-achieving students. The findings showed significant difference (higher achieving: $t = 2.917, p < 0.01$; lower achieving: $t = 4.393, p < 0.01$). It was observed that team teaching had a positive impact on the final exam scores of the experimental groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-test Mean</th>
<th>Pre-test SD</th>
<th>Post-test Mean</th>
<th>Post-test SD</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1</td>
<td>70.68</td>
<td>14.89</td>
<td>74.13</td>
<td>14.30</td>
<td>3.87*</td>
</tr>
<tr>
<td>E2</td>
<td>70.34</td>
<td>15.80</td>
<td>73.94</td>
<td>14.41</td>
<td>7.43*</td>
</tr>
<tr>
<td>C1</td>
<td>70.10</td>
<td>15.91</td>
<td>69.87</td>
<td>15.97</td>
<td>0.576</td>
</tr>
<tr>
<td>C2</td>
<td>71.16</td>
<td>15.34</td>
<td>70.52</td>
<td>15.87</td>
<td>1.408</td>
</tr>
</tbody>
</table>

*p > 0.01.
Responses concerning the team teaching approach

The results from students’ questionnaires are presented in Table 3. More than half (E1: 55%, E2: 52%) of the experimental students surveyed considered team teaching conducive to their final exam performance. Some students thought that the collaborative teachers provided different ways of solving maths problems, giving them the opportunity to learn to think differently. Therefore, they considered team teaching helpful in boosting their final exam performance. Nevertheless, some students found learning two different ways caused confusion in solving maths problems. The following quotations indicate some of the responses of the students:

The two teachers had different teaching styles. They approached the materials from different angles, and taught us different ways to solve problems. I had a chance to think in multiple ways. That should help me in my final exam. (Questionnaire, 25.1.02)

We were learning inequalities for the first time. However, we were confused by the different approaches adopted by the two teachers. We were not sure we understood the math concepts being taught. (Questionnaire, 25.1.02)

Benefits by regrouping students. Teaching was made easier by regrouping students with similar maths ability together in a new class. In addition to the textbook, the teachers added extra materials suitable for the students. Students generally thought that this arrangement facilitated their understanding of the mathematical concepts being taught. Most students agreed that appropriate regrouping was conducive to enhancing their final exam scores:

I think reassigning us to new groups according to our maths ability in the first six weeks really helped our final exam. Our teachers gave us many additional materials. In a regular class teachers would not be able to do so. (Questionnaire, 25.1.02)

Reassigning us to new teaching groups was a blessing for those who had worse maths grades. Mary [team teacher] approached the materials slowly and clearly. I believe my scores will improve. (Questionnaire, 25.1.02)

Students preferred team teaching to traditional teaching

In Table 3, more than half of the experimental students (E1: 62%, E2: 65%) considered team teaching superior to traditional teaching. The reasons for the

<table>
<thead>
<tr>
<th>Items</th>
<th>Agreement</th>
<th>Disagreement</th>
<th>Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team teaching would affect the final exam performance</td>
<td>E1 55%</td>
<td>E2 52%</td>
<td>E1 35%</td>
</tr>
<tr>
<td>Team teaching superior to traditional teaching</td>
<td>E1 62%</td>
<td>E2 65%</td>
<td>E1 31%</td>
</tr>
</tbody>
</table>
students’ viewpoint in this were the two following aspects. On the one hand, the findings of the questionnaire indicated that students felt the two teachers differed in their teaching pace, while, on the other hand, because the teachers’ methods were dissimilar, students had the opportunity to choose the one they considered the more helpful. Also, because they were taught by two teachers, students could learn different methods of solving the same questions:

Mary’s teaching pace was slower than Amy’s. So the former teacher’s teaching was easier to understand than the latter’s. (Questionnaire, 25.1.02)

I was so interested in two teachers teaching together that I seldom dozed off like I did. Besides, I could learn two different methods of solving the same question. (Questionnaire, 25.1.02)

**Examples of two different teaching approaches.** In relation to the students’ reactions to team teaching, the two teachers’ particular reactions were challenged, as a result of their teaching methods in solving problems:

Amy: Let’s try to solve \(-4x + 8 > 0\).
- \(8 > 4x\); there was a minus sign in front of \(4x\), so that we moved \(-4x\) to the right side of the equation
- \(2 > x\), and divided 4 both sides.
John: How come it is not the same as Mary’s method?
Amy: Did Mary teach you to divide minus at both sides?
John: Yes!
Amy: OK, let’s ask a classmate to solve the question, using the method taught by Mary.
Peter: \(-4x + 8 > 0\)
- \(-4x > -8\)
- \(x < 2\).
Amy: Has everyone found that \(2 > x\) and \(x < 2\) are the same?
Peter: Yes!
Amy: So, you have found how interesting mathematics is! If you don’t violate its logic, you’ll get the same answer even if you use a different method. And actually, my method is easier to understand.

(Teaching video, recorded 8.12.01)

As illustrated above, the principles of problem-solving were the same, and there were only different methods. As the different methods appeared in their teaching, the teachers’ individual reactions were important, since if teachers could not solve the students’ confusion over different skills in problem-solving, they would perhaps doubt teachers’ professional knowledge. Another example taken from the conversations between Mary and her students after she had stated the formula solution to a variable equation is as follows:

Mary: Do you remember the formula solution, let’s say it together . . .
Julie: . . . Oh, no! It is wrong to say it that way!
Mary: Really?
Julie: The other teacher [Amy] warned us that it was wrong to say ‘positive and negative’. You must say ‘minus and plus’.

_Team teaching in Taiwan_ 187
Mary: Oh! Right! . . . Yes, you’re right. I’m sorry about that. You are great. You still remembered the differences between signs. I’ll be more careful when saying them next time. Thank you.

(Teaching video, recorded 15.12.01)

And:

I felt rather disgraced when the students corrected my errors! However, I thought that if I had not taught Amy’s class, I would have not discovered my wrong wordings. Therefore, this taught me a lesson. (Mary’s self-reflection, 15.12.01)

Comparison between team teachers. To avoid the above situation, the team teachers became more conscious of accuracy in their teaching. Furthermore, as team teaching also gave students the opportunity to compare their teachers, the team teachers were further encouraged to perfect their teaching approaches. The following conversation was held between Mary and her students in the class:

Tom: [Mary], you emphasized in your teaching the concepts of textbooks, but Amy stressed a lot more how to solve a question.
Mary: Do you want to learn only one way of problem-solving?
Tom: No! I feel good that I can compare the two ways of problem-solving, and now I am not afraid of the mathematics class any more.
Mary: Um, as for me, team-teaching motivates me to teach students until they fully understand.
Tom: Really? Why?
Mary: We are also afraid that you students will compare us and grade us.

(Teaching video, recorded 8.1.02)

Discrepancies between the expectations and implementation of team teaching

Both teachers had certain expectations of implementing team teaching, since they had learned the theory of team teaching at university. However, as they confronted difficulties in the actual process, a discrepancy occurred between their expectations of team teaching and its implementation. Part of the conversation between the researcher (R) and the two teachers is quoted as follows:

R: What did you expect from team teaching prior to implementing it?
Mary: I was glad that I could implement ‘team teaching’ in the first year of my teaching, especially since I had already learned the theory during my training in becoming a teacher.
R: Did you think that there was a major difference between the actual implementation and your expectation?
Mary: The implementation of team teaching was not as easy as I had previously thought because we faced many problems that needed to be solved when implementing team teaching.
R: Amy, what did you think?
Amy: In the beginning, I thought that teachers could bring their strong points into full play, and the students could benefit from being taught by two teachers. But I found that the students had difficulties in adjusting themselves to team teaching. (Interview, 29.1.02)
The difficulties the two teachers confronted when implementing team teaching were due to differences in their personalities and their way of instruction. Part of the conversation between the researcher and Mary is quoted as follows:

R: Did you consider different teaching personalities would cause some difficulties when implementing team teaching?  
Mary: Maybe, I treated students more kindly, but Amy might be more serious. However, we would work it out for the students’ sake.  
R: In spite of personalities, did any other factors affect the implementation of team teaching?  
Mary: Well, we had different ways of instruction. I emphasized textbook concepts, so I spent a lot of time on explanation. Amy believed that apart from the concepts of the textbooks, problem-solving was important. She took time to do the exercises in the supplemental materials. (Interview, 29.1.02)

However, although Mary did not use the supplemental materials as Amy did, the agreement on teaching materials for team teaching was not a problem. The problem was rather the teaching strategy. Mary in her self-reflection found that ‘not all the ways of teaching and problem-solving between team teachers are the same’, and she was afraid that ‘the students would be confused by different approaches to problem-solving’.

The difficulties could be solved through the communications between the two teachers. Also, in order to achieve the goal of team teaching, team teachers needed to learn to be considerate towards each other. The following quotations are taken from the two teachers’ self-reflections:

I think that teachers have to reach agreement on teaching content, strategies, and so on…They need to make efforts to communicate with one another. (Amy’s self-reflection, 15.1.02)

I would keep silent before we reached an agreement for certain things. One of us would always resolve the stalemate. How did we get to this? It should be that both of us had the same desire to achieve team teaching. You could also say that we were considerate towards each other. (Mary’s self-reflection, 17.1.02)

**Derivative problems, such as classroom management and school administration, as related to team teaching**

**Mutual aid/mutual competition in class management.** The two teachers differed from each other in their class management. The implementation of team teaching, therefore, highlighted the problems as to whether team teaching was experienced as mutual aid or as a mutual competition in terms of their class management. Students disapproved of Amy’s classroom management style. They felt that Amy treated them too strictly while Mary was milder in temper:

Even if we forgot to bring the handouts to the class, Mary would not get angry. Instead, she’d remind us not to forget next time; whereas Amy would punish us for forgetting. (Questionnaire, 25.1.02)
I felt that Mary was better than Amy. Mary was more understanding and less demanding in her class management. (Questionnaire, 25.1.02)

Mary was kinder to students whenever they misbehaved. Nonetheless, Amy had a different view on Mary’s class-management skills; she said, ‘never treat your students like friends, otherwise it will be difficult to discipline them’. However, when Amy faced this dilemma, she recalled:

Because Mary always had a smile on her face, all students liked her very much. Because of that, I tried to be as gentle as possible towards students. However, when 20 students forgot to bring their supplemental materials for the second time, I lost my temper. (Amy’s self-reflection, 18.1.02)

Amy questioned her own class-management skills. She felt that her bad temper held her back from implementing Mary’s skills in class management, and she lost her confidence:

I doubt my definition of being a good teacher. Isn’t a good teacher really like what I used to believe? Or is it because I haven’t tried hard enough this time? I am scared that the students are going to dislike me! But, how could I have the idea of ingratiating myself with students? Or should I be that kind of teacher who hankered after winning the students’ favour? I should demand discipline from students, shouldn’t I? And, didn’t I use to think I could achieve both of these two goals at the same time? Why am I like this now? (Amy’s self-reflection, 18.1.02)

The limitation and the coordination of the school administration. To implement team teaching, each team teacher often had to put aside her own teaching schedule, so that she could attend the team meetings. Sometimes, they even needed to hold the team meeting at the weekends or during their vacations. So, the researcher found that it was difficult for teachers to find time for team discussion, since the school administration had not cooperated, especially in reducing the team teachers’ teaching hours. The following is from a conversation between the researcher and Amy:

R: What was the main problem you experienced when implementing team teaching?
Amy: I felt that it was difficult to implement team teaching, because I didn’t have enough time to attend team meetings.
R: Why?
Amy: Each of us was very busy with her own teaching. It’s not easy to find time to meet together. Sometimes I had to put aside my own teaching schedule, so I could attend team meetings.
R: Then, how could you implement team teaching for this project?
Amy: Well, we usually met together to discuss the issues related to team teaching, when both of us didn’t have classes. Sometimes we had to meet at the weekends or even during our vacations. (Interview, 29.1.02)
In addition, team teaching required support from many sides, including the teachers, school administrators and even the students’ parents. Mary recorded the questions asked by her students about team teaching as follows:

I still remember that in the beginning of implementing team teaching, some students asked me: ‘Why did you choose us for implementing team teaching? Is our class not as good as others?’ There was even a student asking: ‘Teacher, are we not like the white mice in the laboratory?’ (Mary’s self-reflection, 4.11.01)

Students did not always understand what team teaching was really about, even after team teachers had sufficiently explained it to them at the beginning of the implementation. Facing doubts as to team teaching from students, team teachers were thus required themselves to fully understand team teaching, especially its benefits for students, so as to give students or their parents (who were involved most of time) the purposes of the approach. However, if the school could inform the parents of the reason for team teaching in written form, then the study could avoid some unnecessary barriers erected among the students, parents and team teachers. Thus the implementation of team teaching would be carried out more smoothly.

**Discussion**

The research aimed to ascertain whether team teaching showed a statistically significant difference over traditional teaching in terms of enhancing student performance. The results showed that the average final exam scores of students receiving team teaching were higher than those receiving traditional teaching. The improvement in students, in these grades, reached levels of significance. From the statistics, the researcher could not precisely pinpoint the reasons for these findings. However, from the responses of students in the post-experiment survey, it was learnt that many students thought the collaborative teachers taught in different ways that were helpful in solving maths problems, and providing them with opportunities to learn to think differently. They therefore thought that team teaching helped to boost their final exam performance.

In addition, students with similar ability were regrouped in a new study class for six weeks. With this arrangement, teachers would provide additional materials based on students’ progress and ability. Students welcomed the arrangement and found it both conducive to their understanding of the materials covered and their final exam success. Furthermore, more than half of students receiving team teaching stated they were in favour of team teaching over traditional teaching methods. They felt that, in addition to the opportunity to learn different ways of solving maths problems, teachers were more motivated and paid more attention to the process of teaching, conscious of students’ comparison of their performances.

As revealed, this research on student performance and attitudes, and the effects of team teaching, brought other findings. A discrepancy between team teachers’ expectations of team teaching and its implementation in practice was noticeable.
Differences in teaching strategy also exposed team teachers to being challenged and compared by students in class. The team teachers had been unprepared to be compared with each other, especially in regard to class management. However, the implementation of team teaching did not win support from the school administration, which impeded teachers in holding team meetings and perhaps caused students to doubt the value of team teaching. Nevertheless, this research found that teachers benefited from team teaching, because the implementation of team teaching not only provided them with the opportunities to collaborate and assist one another in their teaching, but also widened their concept of teaching strategies and class management.

To solve the discrepancy among teachers between the expectations and the actual implementation of team teaching, team teachers were required to make some self-adjustment. The discrepancies noted here were caused by the gap between theory and practice, as well as differences between the two teachers in personality and in their characteristic ways of instruction. If such causes are fully understood, team teachers should be able to adjust themselves well; and these causes might also be disclosed through communications amongst the team teachers. Moreover, the differences here in teaching strategy exposed the team teachers to being challenged or at least compared by students in class. Again, such discrepancies could be resolved by collegial interaction. Under the influence of the traditional, individualistic teaching culture, each teacher had developed her/his own teaching style; they tended not to make public their teaching strategies, except for the teaching observation at school. Teachers were not used to receiving information on others’ ways of teaching. This caused the initial implementation of team teaching to be difficult, since it is of the essence that teachers cooperate in their teaching. Worthy of reflection here is the question as to whether team teachers can overcome their deep-rooted traditional teaching culture.

Further, teachers’ class management approaches also came under the influence of this teaching culture. Every teacher employed their own philosophy and methods in managing a class. Individual teachers were only visitors to others’ classes, and had no need to alter their own ways of class management. When implementing team teaching, however, teachers’ differences in matters of class management could become either a mutual aid or mutual competition. This factor is thus also worthy of reflection for the team teachers. Naturally, the key to implementing team teaching lies with team teachers themselves, but they should be supported by the school administration in two main respects: one involves reduction of team teachers’ teaching hours, and the other is necessary information on team teaching being provided to students and their parents. With this support from the school administration, teachers will be enabled to better implement team teaching.

Conclusion

In 2001, the government in Taiwan caused the primary and secondary schools to implement the nine-year integrated curriculum. However, the trend of the existing teaching culture not only proved a great challenge to its implementation, but also slowed down the process of its implementation. Under the traditional teaching culture, school teachers lacked collegial interaction, and their teaching burden was
not light. In addition, teachers were often conservative in their attitudes, finding difficulty adjusting their perspective or accepting new teaching theories and reformative measurement. Even if we cannot change the current environment, we can at least change our minds.

Due to the adoption of the nine-year integrated curriculum scheme, further research on team teaching would appear to be urgently needed. The present research has probed only the revised ‘station teaching’ modes of co-teaching as advanced by Cook and Friend (1996). Investigation into other modes of co-teaching are now required. Also, since this study has concentrated on only a single subject, studies concerning the implementation of team teaching in the fields of interdisciplinary courses (e.g. the natural and social sciences, etc.) are required. It is suggested that the teachers should be encouraged to drop outdated concepts, to learn and to continually grow. The key, of course, lies with teachers themselves undertaking this more actively, otherwise educational reform cannot achieve its goals.

References


