

Improving reading in a middle school science classroom

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A new strategy for content-area reading instruction was successfully introduced by these authors.

The International Reading Association and the National Middle School Association (NMSA; 2003) reported the discouraging news that American readers get off to a fast start during the elementary grades but begin to falter during early adolescence. In this joint position statement the authors affirmed that a good start is critical but not sufficient, and that “middle school students deserve continued and systematic instruction in reading” (p. 1). The statement recommended that every teacher have the knowledge and skills to integrate reading instruction across the curriculum, and that content area teachers provide reading instruction within their area.

Another major concern among middle school educators is low scores for most students coupled with the lack of a notable increase in students’ overall achievement scores on the National Assessment of Educational Progress (NAEP; National Center for Education Statistics, 2006), a long-term trend in reading assessment. The majority of students (71%) in the most recent assessment were at or above Basic, which denotes only partial mastery of the knowledge and skills that are fundamental for proficient work at a given grade. The percentage of eighth graders per-

forming at or above Basic rose only four percentage points between 1992 and 2005, and there was no significant increase in scores at or above the Proficient level.

Reading in middle school classrooms, such as in science, is common and important. According to the NAEP (National Center for Education Statistics, 2001), 80% of eighth-grade science teachers reported using the textbook regularly. However, weaknesses in textbook content and inef-

fective approaches to teaching with print may prevent textbook reading from being useful. The American Association for the Advancement of Science (2002) reported that science textbooks do a poor job of following standards-based principles for concept learning, a reason science teachers might avoid assigning textbook reading. Wallace (2005) described concerns about matching students’ reading levels and the reading levels of their assigned textbooks. Fleming and Billman (2005) found that science texts may confuse students, contain unfamiliar vocabulary, and present challenging text structures. Summarizing the situation, the authors stated that many textbooks that teachers use are difficult for their students. According to Greenwood (2004), many middle-level students “hit the wall” when it comes to content area reading.

To address some of these issues, Haury (2000) recommended that science teachers help students adopt a purposeful stance and a ques-

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tioning attitude for textbook reading. This stance and attitude can be implemented in the classroom as strategies for content area reading.

The effectiveness of reading strategy instruction

A substantial body of research documents the effectiveness of strategic reading instruction for middle school students on their comprehension of text (Trabasso & Bouchard, 2002). Explicit strategies prompt students to engage their prior knowledge and to monitor their comprehension. Despite evidence of the effectiveness of these strategies, a number of studies (reviewed by Pressley, 2002) have reported that few teachers use them in their instruction. To change their instructional routines, teachers likely need added support.

Teachers looking to follow Haury's (2000) recommendation for the science classroom may seek research to recommend the most popular strategies specific to study-reading with textbooks. A relatively new strategy for comprehending and studying textbooks called PLAN (Predict-Locate-Add-Note) has been demonstrated to be effective with middle school students (Caverly, Mandeville, & Nicholson, 1995;

Radcliffe, Caverly, Peterson, & Emmons, 2004). PLAN orchestrates a repertoire of strategies that have been validated with upper elementary and middle school students: relating the text to prior knowledge, questioning, summarizing (Pressley, Johnson, Symons, McGoldrick, & Kurikta, 1989), using imagery, and setting a purpose for reading (Brown, 2002). Specifically, PLAN begins with an assessment of the reading task demand, such as taking a chapter test or writing a paper. With the task for reading in mind, students predict (P) the content of the text and construct a tentative concept map; locate (L) on the map what is known by placing checkmarks and what is not known by placing question marks; add (A) links to the map during the reading of the textbook to confirm checkmarks and to address the question marks; and note (N) a reformulated understanding by revising the map, writing a summary, or performing any other task that might be aligned with the purposes for reading (see Table 1). In using mapping, PLAN improves upon other strategic approaches to textbook reading. The value of student construction of concept maps has been well documented for the science classroom (Al-Kunified & Wandersee, 1990; Stoddart, Abrams, Gasper, & Canaday, 2000).

Table 1
Description of steps in PLAN

Step	Description	
P	Predict	Predict content and structure of the text before reading. Students create a probable map based on text title, subtitles, and graphics.
L	Locate	Locate on the map the known and unknown information before reading. Students place checkmarks by known information and list question marks by unknown information.
A	Add	Add words and phrases to the map during reading. Students add notes that explain unknowns and that confirm known information.
N	Note	Take Note of new understanding. After reading, students may change the map, reproduce the map, or discuss the map.

The purpose of this research was to examine the effects of introducing the PLAN study-reading strategy into a middle school science classroom. We asked the following research questions:

- How does one middle school science teacher change her instruction over a school semester as she is mentored in teaching with the PLAN strategy?
- Is PLAN effective in helping middle school students learn science?
- How do students perceive their use of the strategy?
- How do the teacher's perceptions about her confidence and competence in her ability to teach a reading strategy in science class change as PLAN is implemented?

Methods

Research design

The study followed a nonequivalent-groups, pretest–posttest design with multiple pre- and postassessments to evaluate how the learning and perceptions of students who used the PLAN strategy compared to their peers in a similar class who did not use PLAN. Two sixth-grade science classes participated in the study, one as a treatment group and the other as a control group, and all students were assessed with two science comprehension assessments as pretests and two comprehension assessments as posttests. This quasi-experimental design provided a more rigorous investigation than had prior research about PLAN.

Participants

Participants were the science teacher Mrs. Lee (pseudonym) and 50 sixth-grade students in two of her science classes from a middle school enrolling approximately 900 students, located 10 miles from Austin, Texas, a major metropolitan area in the United States. Mrs. Lee held a master's degree in education, had 30 years of teaching ex-

perience, taught five science classes daily, and led a sixth-grade interdisciplinary team. A comparison of scores on the district's annually administered Gates–MacGinitie Reading Test (2000) was made between the two classes involved in this study. Analysis of the students' scores did not reveal a statistically significant difference, $t(47) = -.770, p = .445$, between the treatment group's score ($M = 8.36$) and the control group's score ($M = 7.86$). The class of 23 students using the PLAN strategy included 14 white, 8 Hispanic, and 1 African American student, and was 43% male. The class not using the PLAN strategy included 11 white, 13 Hispanic, and 3 African American students, and was 63% male.

Data sources

Mrs. Lee administered reading comprehension tests and a reading strategy checklist before and after five weeks of PLAN instruction. The teacher completed a questionnaire prior to learning the PLAN strategy and at the end of this five month study. She also participated in a poststudy interview conducted by one of the researchers (Radcliffe). During the project we collected additional information with field notes and digital videotape. These data sources are described next.

Teacher questionnaires and interview. At the beginning and end of the study Mrs. Lee completed virtually identical questionnaires that included eight open-ended questions about her teaching approaches, her students' performance before and after introduction of the PLAN strategy, and how the treatment group's performance compared to the control group. An example of a posttest question is "How will your approach to assigning print material change?" The teacher was interviewed by one of the researchers (Radcliffe) in an hour-long, structured interview with questions that paralleled the question prompts in the questionnaires. One of these questions was "How did you introduce the PLAN strategy?"

Textbook chapter reading comprehension tests. Mrs. Lee followed her regular instructional rou-

tine for creating the reading chapter comprehension tests, selecting questions from the textbook publisher's test bank (Glencoe/McGraw-Hill, 2002) and creating additional questions. An example of a test item from the chapter on living things is "Describe an example of mutualism among animals." The tests were designed to be moderately rigorous in order to assess different levels of student learning. The content validity of the tests was supported by the use of the publisher's (Glencoe/McGraw-Hill, 2002) test bank for most questions. We calculated interrater reliability on Mrs. Lee's test bank at 99%, by dividing the number of agreements by the total number of agreements and disagreements and multiplying by 100 (Sulzer-Azaroff & Mayer, 1977) for each measure on 30 of the test protocols from a randomly selected sample of pretests and posttests. Two reading tests for two earlier chapters served as the pretests and two tests for two later chapters were the posttests. The tests averaged 15 items and included true or false, sentence completion, and short-answer items that invoked comprehension, application, and inferential types of thinking. The purpose of the tests was to assess students' comprehension of the textbook chapters.

Reading strategy checklist. The reading strategy checklist included 10 yes or no questions regarding which strategies students used for reading a textbook chapter and for monitoring comprehension (see Figure 1). A total of 10 points were possible with each "yes" response generating a point. A higher checklist total score represented greater strategy awareness and use. The content validity of the checklist was supported by its use in previous studies (Radcliffe et al., 2004). This checklist was adapted from a list developed by one of the coauthors of the initial PLAN publication, Sheila Nicholson (Caverly et al., 1995), who had used it for many semesters with developmental college readers.

Field notes and digital film. A notebook documented our conversations with Mrs. Lee and our classroom observations during the study. Additional information was collected by produc-

ing a two-hour videotape that chronicled Mrs. Lee's fidelity in implementing the steps of the PLAN strategy as she taught it to her students.

Data analysis

The data from the reading comprehension tests and reading strategy checklists were analyzed using SPSS (Statistical Package for the Social Sciences) statistical test software. We individually reviewed and then discussed Mrs. Lee's responses to the questionnaires and interviews, and reached consensus on the meaning of this data.

Procedures

The study proceeded in three phases—a preparation phase, during which Mrs. Lee gained strategy instructional awareness; an implementation phase, during which she gained contextual strategy instructional knowledge; and an adaptation phase, during which she gained strategy instructional control.

Preparation. At the time of the study, Mrs. Lee was expanding her knowledge of instructional strategies through graduate coursework in a curriculum and instruction program for middle grades teachers. She was taking a class that focused on conducting field research, as well as a class on teaching reading in the middle and secondary school where she initially learned how to teach PLAN. After expressing interest in trying out the PLAN strategy in her middle school classroom, we all prepared for this study.

Implementation. At the beginning of the implementation phase, Mrs. Lee was interviewed by Radcliffe (first author) using the teacher questionnaire and interview. Then, for two months in the winter term, Mrs. Lee met weekly, for a total of more than 15 hours, with Radcliffe and Caverly (second author), subsequently referred to as the mentors. During the meetings, the mentors, Hand (third author), and Mrs. Lee held in-depth discussions of the processes of strategic

Figure 1

Reading strategy checklist

Date _____

Directions: Carefully read the following statements and honestly respond to them using the scale below. Circle either A or B

A = Yes, I did this in preparation for this quiz

B = No, I did not do this in preparation for this quiz

- | | | |
|---|---|---|
| A | B | 1. I made predictions about what the author would say next or what would happen next. |
| A | B | 2. I connected ideas from my own experience to what I read. |
| A | B | 3. I figured out new words by the ones around them. |
| A | B | 4. I created a map of the ideas from the reading. |
| A | B | 5. I created examples from my own experience to help my understanding. |
| A | B | 6. I memorized key terms. |
| A | B | 7. I reviewed the passage after reading to make sure I understood. |
| A | B | 8. I skipped parts I didn't understand. |
| A | B | 9. I tried to put the important ideas in my own words. |
| A | B | 10. I identified the purpose the author had for writing. |

textbook reading and the challenges of implementing those in a middle school classroom.

Concurrently, Mrs. Lee taught the PLAN strategy in one of her sixth-grade science classes (the treatment group) while a second sixth-grade class (the control group) followed her traditional instruction without PLAN, as did her three other science classes. She used the following steps to teach the strategy:

- PLAN was introduced as a new way for students “to know and understand based on reading their science textbook.”
- The teacher illustrated how to create concept maps on the board.
- The students created concept maps in groups and then individually.

- The students individually completed the four steps of the PLAN strategy based on content in their science textbook.

The instruction followed Pearson and Gallagher's (1983) steps of explicit instruction, by modeling the strategy for students, providing scaffolding during guided practice, and structuring time for independent strategy use by students so they could internalize the processes. During this time, Hand (third author) videotaped Mrs. Lee to establish fidelity of instruction.

Adaptation. In the spring term, Mrs. Lee did not meet with the mentors, but remained in e-mail contact. At this point, she focused on integrating PLAN with her instructional routine and on promoting in students the idea of adapting it to be

an individual “plan” for strategic textbook reading. At the end of the adaptation phase, Radcliffe (first author) interviewed the teacher using the teacher questionnaire and interview.

Findings

How Mrs. Lee changed her instruction

Several findings about changes in Mrs. Lee’s instruction emerged from analysis of the teacher pre- and postquestionnaires, and of the transcript of the teacher interview conducted at the end of the study. She integrated reading instruction with her curriculum, changed her routine for science textbook reading, and extended the use of PLAN strategies to science labs.

Mrs. Lee changed her practice by integrating reading instruction with the science curriculum for the treatment group. In a move that may have surprised some students, the teacher directly and rigorously challenged the science students with questions about how they read. During science class, students became engaged in discussions of what it takes to be a successful reader, created foldable paper projects that described what a successful reader is, and prepared a concept map on the board of what a successful reader does. In their projects the students stated that using reading strategies is important and that prior knowledge and vocabulary are keys to successful reading. During the classroom discussions the students proposed other important strategies including rereading for understanding, eliminating distractions, and looking for content clues. Mrs. Lee assigned several brief, challenging reading exercises that included complex ideas and college-level grammar. Following these assignments the students discussed what it felt like to not completely understand text and further discussed the importance of using reading strategies to understand new science material.

Mrs. Lee changed the routine for reading the science book by implementing the PLAN approach in place of a silent reading strategy. Before

the intervention all of her classes including the treatment group students silently read their textbooks while listening to an audio recording of the chapter that was played for the whole class. During the research project she continued that practice for the control group and her other three classes. As confirmed by our observations and the videotaping, Mrs. Lee instructed the treatment group students about the PLAN steps and modeled them. The class worked together to create a concept map on the board. The teacher reported the students’ positive reactions: they enjoyed the map making and said things like “this makes sense.” The teacher then guided students in class as they individually previewed a textbook chapter by looking at the title and subtitles, size of letters, color of letters, and how the text was organized. Based on what seemed important in the previewed pages they predicted the chapter content and illustrated this by drafting a concept map. After noting on the map what was known and unknown, they proceeded to read the chapter, adding notes to the map about what they learned and read. In the classroom discussions that followed the students shared their new learning. Subsequently, they used PLAN for additional reading assignments.

Mrs. Lee extended the use of the PLAN approach to labs, asking students to predict what the lab would cover, comment on what was known and unknown, and then discuss what they learned during and after the lab. The students’ participation in the PLAN activities was part of their daily grade.

PLAN is effective in helping students learn science

Several findings supporting the effectiveness of PLAN were revealed by statistical analysis of the students’ comprehension test scores and reading strategy checklists, and through analysis of Mrs. Lee’s pre- and postquestionnaires and postinterview.

Comprehension tests. Comparisons of students' comprehension test scores were made between the treatment group and control group using a *t*-test statistic (two-tailed). Each student's two pretest scores were averaged to create a pretest measure, and each student's two posttest scores were averaged to calculate a posttest measure. Analysis of the groups' mean scores on the pretests found that there was not a statistically significant difference ($t(50) = -.360, p = .721$) between the treatment group's pretest score ($M = 73.5$) and the control group's pretest score ($M = 72.2$). The difference between the two groups' posttest scores was statistically significant ($t(47) = -4.579, p = .000$), with the treatment group's posttest scores ($M = 68.9$) exceeding the control group's posttest ($M = 52.8$).

Reading checklists. Analysis of the groups' pretest and posttest mean scores on the reading checklists revealed several findings. On the pretests there was not a statistically significant difference ($t(47) = .435, p = .666$) between the treatment group's pretest scores ($M = 5.15$) and control group's pretest scores ($M = 5.44$). The difference between the two groups' posttest scores was statistically significant ($t(47) = -2.61, p = .012$), with the treatment group's posttest scores ($M = 6.68$) exceeding the control group's posttest ($M = 5.00$). The treatment group also demonstrated a statistically significant gain in scores ($t(39) = -2.270, p = .029$) from their pretest ($M = 5.15$) to their posttest ($M = 6.68$), and the control group did not demonstrate a statistically significant difference ($t(55) = .711, p = .480$) between their pretest ($M = 5.44$) and posttest ($M = 5.00$). This gain in reading strategy scores was supported by the teacher interviews and questionnaires in which Mrs. Lee reported that the treatment group became more enthusiastic about reading and seemingly more knowledgeable about the reading process than the control group.

Teacher interview and pre- and poststudy questionnaires. Several findings supporting the effectiveness of PLAN emerged from analysis of the

teacher questionnaires and of the transcript of the teacher interview conducted at the end of the study.

Mrs. Lee reported differences within the treatment group between ability-level groups in terms of how rapidly they mastered PLAN and how helpful it was. Her "higher ability students" quickly adopted the PLAN approach and used it successfully as was evident from comparing their posttest scores and those of the control group. Her "regular ability students" were much more challenged by PLAN; however with teacher coaching they mastered it and used it successfully as was evident in the comparison of posttest scores from the treatment and control groups. Mrs. Lee reported that PLAN was most helpful to students with learning difficulties. These students needed the most support in adopting this reading strategy but analysis of their posttest scores led her to conclude that PLAN was "most helpful" in their case.

Mrs. Lee reported improvements in the treatment group's test performance when compared to the control group. With regard to the two groups' performances on the chapter tests she summarized that the treatment group "did a lot better on the posttests."

Mrs. Lee also reported that all students in the treatment group moved from needing classroom support with strategic reading to being more independent in their strategy use and able to do the reading as homework. In comparison, students in the control group continued to listen to a recording in class while reading silently.

At the end of the adaptation phase, Mrs. Lee stated that PLAN was a "good tool to teach the kids" and that the text becomes a useful resource if you know how to approach it. She concluded that "PLAN opens the door to better understanding" and "teaches kids greater respect for books." Students are "able to grasp and understand more and make more connections."

A related finding concerns how Mrs. Lee introduced PLAN. She provided instruction that was developmentally responsive to the cognitive

and social-emotional needs and characteristics (NMSA, 2003) of middle-level students.

How students perceive the use of PLAN

In the poststudy interview and survey Mrs. Lee reported that her students enjoyed making the concept maps. Within the treatment group, reading had become more enjoyable. She stated that the PLAN approach strengthened their self-esteem and their perception changed, from “I can’t do this” to “I can.” In particular the students enjoyed writing about what they had learned. Students gained self-confidence as they discussed how “they knew more than they thought” from reading while completing the PLAN locate and add steps. Mrs. Lee reported that she could see the positive look on their faces after they received grades on the posttests. Using the PLAN reading strategy was much more enjoyable than silent reading while listening to a recording of the text.

The teacher’s perceptions about using PLAN to teach science

Several findings about Mrs. Lee’s perceptions about textbook reading in her classroom emerged from analysis of the transcript of the teacher interview conducted at the end of the study and of the teacher pre- and poststudy questionnaires. As Mrs. Lee began to learn about PLAN in the mentoring sessions she became enthusiastic about introducing it to her students. In the prestudy questionnaire she predicted that they would do great and “I think self-esteem will increase.” This enthusiasm grew during the semester as she integrated PLAN with her science class. Mrs. Lee noted that “they bought into it” when the students understood how it worked and they could see that it helped their test grades. On her poststudy questionnaire she predicted that she would use PLAN with more lessons in the future. During the interview at the end of the study the teacher comment-

ed on the impact the strategy had on all students: “the bottom line with this approach is success.”

Discussion

Major findings

This study reveals how a middle school science teacher implemented strategic reading instruction through a collection of strategies for study-reading called PLAN. It describes how she used an instructional approach that was developmentally responsive to the characteristics and needs of her students. The study compares measures of reading comprehension for treatment and control groups, and reports the improvement in the treatment group students’ ability to learn from textbook reading in comparison to the control group. Consistent with the case study of Driscoll, Moallem, Dick, and Kirby (1994) and other middle school findings (Caverly et al., 1995; Radcliffe et al., 2004), Mrs. Lee was hesitant to rely on textbooks for learning. Prior to this study her students listened to an audio recording of their science textbook chapter while they silently read the chapter in class. At the end of the study Mrs. Lee and the students in the treatment group had gained enthusiasm and confidence in their ability to learn by reading.

Comparison to prior study findings

Consistent with two prior studies that demonstrated PLAN to be effective with middle school students (Caverly et al., 1995; Radcliffe et al., 2004), the students in the current study benefited from the use of PLAN, as documented by gains in their comprehension test scores when compared to a control group. The gain in scores was statistically significant ($p = .000$) and also practically significant because the treatment group demonstrated a 16-point gain on a 100-point assessment. Similar to Radcliffe et al.’s (2004) study, after three months of strategy use, treatment group students’ posttest scores on the reading strategy checklist indicated that they engaged in

additional reading strategies, such as summarizing what they had read. In the current and prior study, the teachers were pleased with their students' reports that reading science textbooks helped them to learn science. In both studies, postassessment interviews revealed that the teachers changed their instructional routine, moving through stages of strategy awareness, understanding, and adaptation. The teachers also increased their expectations regarding the positive effect of textbook reading on student learning.

The current study is significant because it uses a stronger research design than the prior studies, specifically a nonequivalent-groups, pretest-posttest design with multiple pre- and postassessments based on chapter comprehension tests. The prior study (Radcliffe et al., 2004) used a single-group pretest-posttest design and analyzed comprehension gains based on concept maps that students created before and after learning to use the PLAN strategy.

Findings related to middle school instruction

An important finding was in the way Mrs. Lee introduced PLAN. She provided instruction that was developmentally responsive to the cognitive needs and characteristics of middle-level students. Initially she challenged students with questions about what it takes to be a successful reader. Mrs. Lee used multiple approaches to press this challenge upon the class including classroom discussions, foldable paper projects, and concept map exercises. Based on NMSA (2003) guidelines, her instruction was developmentally responsive to four cognitive-intellectual characteristics of middle-level students:

1. Her discussion and board work met a variety of intellectual levels.
2. The project provided for both abstract and concrete learning experiences.
3. The use of concept maps allowed for active rather than passive learning.

4. The group work provided for interaction with peers.

Mrs. Lee's instruction was also developmentally responsive to the social-emotional needs and characteristics of middle-level students. Initially the teacher encouraged students to discuss how it feels to not understand or know, and their frustration in grasping the meaning of a challenging reading. After the pretest the class discussed how they felt about not being able to answer some of the questions because they did not use the right study and reading strategies. Students felt embarrassed, worried, anxious, startled, scared, and nervous. Mrs. Lee introduced PLAN by explaining that it was a really good way to help them understand things in a short amount of time and feel good about themselves. She reported that as the students learned PLAN, they discussed how they "felt good" when they shared about what they learned in the Locate and Add steps. The teacher reported that after the posttest, the chapter test grades were up and "this had significant meaning"; the class discussed how they felt and "you could see the positive look on their faces." Mrs. Lee repeatedly engaged the students in reflection and sharing of their feelings, which were growing more and more positive as the students progressed through introduction of a challenging reading, creation of a classroom concept map, completion of their own PLAN steps, and finally improvement on test scores. In summary, Mrs. Lee helped students recognize their growth from discomfort to comfort with reading science books, their mastery of a new reading strategy, and their success on chapter quizzes. Based on the NMSA (2003) guidelines, her instruction was developmentally responsive to several social-emotional and psychological characteristics of middle-level students by supporting students' strong need for approval, helping stabilize their fluctuating self-esteem, and nurturing their high level of self-consciousness and preoccupation with themselves.

Adopting a strategic reading strategy in science class

Another finding of this study was that adopting the PLAN strategy involved substantial time and effort by the teacher and mentors to modify the teacher's instructional routine. Mrs. Lee had to develop skills in strategic reading instruction and gain confidence that the students would learn from her delivery of it. Consistent with Pressley (2002), this teacher developed in her ability to teach students effective study-reading strategies. Mrs. Lee progressed through three stages as she implemented PLAN:

1. Awareness of the strategy
2. A deeper knowledge and understanding of both why and how to teach it
3. Control of the strategy to meet the students' needs for learning science content

Limitations

Although these findings support and extend prior research about PLAN (Caverly et al., 1995; Radcliffe et al., 2004) they are limited by several factors. First, the five-week span between pre- and posttests was probably not enough to show the full benefit of the strategy adoption and adaptation. The study is also limited because the approach used nonequivalent groups. A threat to the study's validity exists because the students in the treatment and control groups were instructed by the same teacher. To help ensure internal validity the researchers discussed this threat with Mrs. Lee prior to the study, cautioning her to instruct the treatment and control groups in the same manner except for using PLAN. The videotape of Mrs. Lee instructing with PLAN allowed the researchers to verify that she was not overly zealous in teaching the treatment group. To reduce these threats, future studies could use an equivalent groups design that includes several teachers and could conduct the study for at least six months. An additional recommendation is to include structured pre- and postinterviews with

students in the treatment and control groups to confirm the teacher's report of positive changes in the students' perceptions about reading science textbooks.

The PLAN strategy is complex but rewarding

A quasi-experimental research design revealed that students who used the PLAN strategy for reading their science textbook demonstrated higher scores for reading comprehension and reading strategy use than students who used a silent reading approach. Textbook reading in this classroom became an assignment where students actively completed concept maps and related tasks. Over a period of five months, the teacher's classroom routine changed to include strategic reading instruction for the use of textbooks. Mrs. Lee implemented the PLAN strategy using developmentally responsive approaches that are consistent with the characteristics and needs of young adolescents (NMSA, 2003). She moved through the stages of strategy awareness, understanding, and control, while the students progressed from observing the teacher model PLAN to using it in small groups, individual classroom practice, and homework. Mrs. Lee gained confidence in her students' ability to learn by reading the textbook. Students changed their learning strategies, to use concept maps and related aids at home on textbook chapters. Mrs. Lee reported that her students gained self-confidence in reading and found reading to be more enjoyable. Consistent with prior studies, such as that of Trabasso and Bouchard (2002), we concluded that strategic reading instruction helped students learn from their textbooks. Following International Reading Association and NMSA recommendations (2002), Mrs. Lee gained knowledge and skills to integrate reading instruction across the curriculum and began to provide reading instruction within her content area.

In this study Mrs. Lee also applied the strategy to meet her instructional needs during

science labs. We believe that this adaptation phase is important, specifically that strategic reading instruction must be integrated with the teacher's instructional routine. For example, using PLAN as a vehicle for students to develop general knowledge and concepts served to link textbook reading and the hands-on activities that are often preferred in teaching science.

Implementation took considerable time and effort; Mrs. Lee committed to graduate coursework and mentor support in her effort to learn about and implement strategic reading in her course. Therefore, teacher educators need to evaluate whether reading workshops or a single reading strategy course are sufficient to enable participants to implement complex new strategic reading routines such as the PLAN strategy.

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