FINDINGS

Section I describes the principal results from the experimental studies described in the Activities Section. The experiments examine the effects of reading strategy training with iSTART (McNamara, Levinstein, & Boonthum, 2003). The general structure of these experiments is reported in the activities section. Only unique details are reported here, such as the type of school, the participant population, or particular experimental procedures. Section II reports the findings from the observational studies conducted during training and practice (Experiments 3, 4, 5, and 6) and data on the teachers' opinions of iSTART collected at the summer workshop in June 2004. Section III describes the results of studies to improve the performance and usability of iSTART by considering effects of reading skill, text, and response mode.

I. iSTART Experiments

First, we describe additional analyses examining the correlations between middle-school students' self-explanation quality and the comprehension performance following iSTART v1.0 training (Experiment 1). We then describe the results of a study conducted with high-school students who were trained with iSTART v2.0 (Experiment 2). Finally we report studies conducted in high-school classrooms that combine iSTART training with extended practice (Experiments 3, 4, 5, and 6). These experiments examine the effects of integrating iSTART into the classroom by adding extended practice.

A. Experiment 1: Evaluation of iSTART v1.0 with Middle-School Students

The results of the comprehension analyses for this study were presented in the 2003 report. However this year, we present analyses on the quality of self-explanations with iSTART v1.0, and how they relate to comprehension. Thus, we report here how training benefits students' reading comprehension performance as a function of students' ability to use strategic self-explanations.

The sample consisted of 39 eighth and ninth grade children enrolled in a learning program, called Learning Bridge. We do not describe the details of the study in this section because a complete description of the study was provided in last year's progress report. Instead, we report the results of a new analysis that emerged in the ongoing data analyses following the preparation of last year's progress report. We have scored (using the procedure described in the activities section of the 2003 progress report) the self-explanations produced for a 19-sentence text describing various causes of heart disease. We examined the effects of iSTART training on students' ability to produce quality self-explanations.

An ANOVA revealed a significant effect of training condition (iSTART trained versus non-trained control), $F(1,37)=13.02$, MSE = .362, $p < .01$, indicating that iSTART students produced better quality self-explanations (M=1.11, SD=0.79) than control students (M=0.41, SD=0.38). A 2 x 2 ANOVA including training condition (iSTART or control) and reading strategy knowledge (high or low, as assessed at pretest) demonstrated a main effect of reading strategy knowledge, $F(1,34) = 9.41$, MSE = .259,

p<.01; students with high reading strategy knowledge obtained higher self-explanation scores (*M*=0.90, *SD*=.80) than students with low reading strategy knowledge (*M*=0.49, *SD*=.39). The interaction between training condition and strategy knowledge was not reliable. The main effect of training condition was also significant in this analysis, $F(1, 34) = 17.2$, $p < .001$. These combined results suggest that iSTART improves a student's ability to self-explain, regardless of their prior-knowledge of reading strategies.

We analyzed the correlations between the self-explanation scores of critical sentences (sentences whose information is required to answer a comprehension question) and students' performance on those comprehension questions. The analysis indicated that the correlation was significant for participants in the training condition, $r=.727$, $p < .01$. The same correlation was only marginal for participants in the control condition, $r = .400$, $p=.07$. The results of these analyses suggest that iSTART training improves reading comprehension performance through improvement in the skill to self-explain sentences.

B. Experiment 2: Evaluation of iSTART v2.0 with High-School Students

This study was designed to investigate the effectiveness of iSTART v2.0 for teaching high-school students SERT strategies to improve reading comprehension of science texts. In contrast to our previous investigations of iSTART, this study was conducted in the students' classrooms during real class time. Thus, this study also served to examine the usability of iSTART for real classroom settings in public high-schools. One of the challenges observed was ensuring that there were secure and stable internet connections in classrooms for multiple notebook computers (that were used simultaneously). The main goals of the study were to assess the quality of self-explanations produced for science texts and the comprehension of the texts as a function of iSTART v2.0 training. Self-explanation quality and comprehension were both assessed at two points; immediately following training and after a delay (during posttest).

The participants were 435 Shelby County Tennessee high-school students. The classes taught by five teachers, included 10 biology classes (10^{th} grade) and 10 physical science classes (9^{th} grade). All of the students completed the pretest (e.g., science knowledge, vocabulary, reading comprehension, etc) in September, 2003, and the posttest in April, 2004. One half of the classes were trained in November, 2003, and the remaining half in January, 2004. Using matched-samples assignment (based on reading skill and prior knowledge), half of the students in each classroom were assigned to the iSTART condition, and half were assigned to the control condition.

The students in the control condition were trained to design web pages containing science-related information. The web design task was developed to engage students in a computerized task, while at the same time exposing them to the same text materials used in the iSTART training condition. Thus, this task controlled for the effects of novelty pertaining to computer use, as well as exposure to scientific information involved in iSTART training. Following the iSTART and web design training phase, both the experimental and control participants completed a self-explanation test and a science comprehension test to examine whether iSTART training facilitated self-explanation quality and enhanced comprehension of science texts.

Overall, the results from last year's report indicated that the iSTART participants scored higher on a comprehension measure than participants in the control condition. The advantage of iSTART participants over control participants was evidenced even when individual differences such as reading skill, strategy knowledge and science knowledge were co-varied out. However, the goal of this year's analyses was to examine the impact of training on students' ability to improve the quality of their self explanations. Students in both conditions were asked to self-explain six-sentence texts at pretest, immediately after training, and at posttest. This design allowed us to track any changes in the quality of student self-explanations over time. The quality of self-explanations was assessed by the iSTART algorithms. The iSTART algorithm assigns scores to self-explanations based on a 4-point scale where higher quality explanations are assigned higher scores (see the Activities Section and the 2003 report for details).

To determine whether there were any pre-test differences in self-explanation ability, we performed an ANOVA on the pretest self-explanation scores as a function of training condition (control, iSTART). The analysis revealed that before training, there were no significant differences in the quality of self-explanations as a function of training condition, $t(434)=1.30$, $p>.05$. However, the quality of the self-explanations immediately following training were significantly higher for the iSTART condition ($M=1.33$, $SD=.46$) than for the control condition ($M=1.24$, $SD=.44$), $t(399)=1.91$, $p<.05$ [one-tailed], Cohen's $d=.20$. This indicates that the iSTART training helped improve the quality of students' self-explanations.

To determine whether the improvement in self-explanation quality persisted over time, we examined the students' self-explanation scores at posttest. The analyses revealed that self-explanation scores were not significantly different across conditions at the time of posttest, $t(374)<1$. In summary, iSTART helped improve students' self-explanation scores immediately after training, but not after an extended delay. These results lend support for extending the training to include more self-explanation practice over time. With additional practice, students are expected to continue to show the benefits of training over longer durations. The effect of extended practice was the focus of Experiments 3, 4, 5 and 6 of this report.

II. Teachers' Evaluations of iSTART

This section reports the analyses performed on the teachers' responses to and observations/evaluations of iSTART and iSTART training. The first analyses focus on the results of the iSTART workshop questionnaire, which assessed teachers' opinions of the training and iSTART in general. The second analysis focuses on observations of teachers' implementation of iSTART and conducting the weekly practice sessions (Experiments 3, 4, and 5) and daily practice sessions (Experiment 6).

A. Teachers' views of the iSTART workshop

One of the key goals of our project is to integrate iSTART into the high-school classroom. To meet this goal, it is necessary to train teachers to administer the training and determine how our current system complies with the current needs and constraints of

the classroom. We have taken initial steps toward integration by training teachers to administer reading strategy training using iSTART. During summer 2004, eight teachers from two Shelby County Tennessee high schools participated in a three-day iSTART training workshop. During the workshop the teachers 1) were presented with the theoretical basis for the development of iSTART (including sessions on the cognitive processes involved in text comprehension and on models of text processing and how these related to the reading strategies taught with iSTART), 2) went through the iSTART v2.0 strategy trainer, and 3) provided feedback on parts 1 and 2. The eight participants included three science teachers (who participated in Experiments 3, 4 and 5), a reading-class teacher (who participated in Experiment 6), two English teachers, one high-school reading lab director, and one high-school computer technician (and former teacher).

At the end of the three-day workshop, we administered a questionnaire to each teacher. The overarching goals of the questionnaire were to gain ideas about 1) the level of background instruction about text processing and about the computer system that we need to provide to teachers in order to implement iSTART in regular high-school classrooms, and 2) the perceived usefulness of iSTART as a classroom teaching tool. Table 2 presents teachers' perceptions of the workshop and its relevance to using iSTART in high-school classrooms. All questions required teachers to provide open-ended responses. Answers were classified into categories (see tables below).

For questions concerning the workshop, we classified the teachers' responses to each question as either positive (i.e., "yes" response) or negative based on the content. Table 2 reports the frequencies of positive responses produced by the eight teachers. The data indicate that overall, teachers felt positive about the training workshop. All teachers found the workshop helpful and most of them indicated that it helped them understand iSTART. Importantly, the data indicated that teachers had some prior knowledge regarding the reading strategies used in iSTART (e.g., concept of elaboration) and used strategy training in their classroom activities. Teachers' knowledge about the strategies and the fact that they already apply some of the iSTART strategies is likely to make it easier to integrate iSTART into their curriculum.

Table 2. Opinions regarding the reading strategy workshop

Question	Positive responses N
Was the presentation clear and comprehensible?	8
Did you find the information useful to your learning about and understanding iSTART?	6 (2 teachers did not answer question)
Did you find the information beneficial/useful beyond how it might be applied to iSTART training?	7 (1 teacher did not answer question)
Have you been exposed to any of the presented concepts previously? If yes, which concepts?	8
Do you already use/apply any of the presented concepts when teaching? If yes, which concepts?*	7
Do you think you would use the presented information in some non-iSTART capacity in your classes?	7 (1 teacher did not answer the question)

* Note that the teachers did not specify which strategies they used

Table 3 shows responses to questions about the usefulness of iSTART. All of the teachers indicated that the iSTART training workshop helped them understand how and why iSTART facilitates text comprehension. All but one teacher foresaw using iSTART after the workshop intervention (the reading lab director provided the negative response and works with students exhibiting word decoding deficiencies, a lower-level processing deficiency that cannot be addressed with iSTART training). Of the teachers who specified how they would implement iSTART, approximately half reported that they would use it with students of all levels, whereas half indicated they would use it for "lower-level" students (e.g., students with comprehension difficulties). Further, the five teachers who answered the question about frequency of use reported that they would implement self-explanation practice on a regular basis. Overall, the workshop data are encouraging with regard to the teachers' perceptions on using iSTART in the classroom.

Table 3. Perceived use of iSTART

Question	Responses N
Did you find the iSTART training left you with a clear understanding of how and why iSTART can facilitate text comprehension?	8 = positive response
Do you foresee using iSTART in the classroom after the IIS intervention at your school?	7 = positive response 1 = negative response
In what context might you use iSTART in the classroom (i.e., all students, students with comprehension difficulties, etc.)?	3 = all students 3 = lower-level students 1 = train teachers to use 1 = not applicable
How often would you use iSTART and/or its related concepts (i.e., training only, training and extended practice, once a week, daily, etc.)?	4 = weekly practice 1 = monthly practice 2 = did not specify 1 = not applicable

B. Observations of teachers administering iSTART and extended practice sessions

We observed teachers administering iSTART and extended practice sessions in high-school science classes (Experiment 3, 4 and 5) and the reading class (Experiment 6). The purpose of the observations was to examine whether and how teachers can administer the training and the extended practice sessions. The teachers who participated in the 2004 summer workshop guided students through the training and extended practice sessions.

Two types of observation were conducted: 1) University of Memphis iSTART researchers recorded observations of the teachers administering iSTART training and extended practice, and 2) the teachers recorded their observations of the students' experiences of iSTART and extended practice.

The observation data were collected from four teachers. Teacher A conducted Experiment 3, Teacher B conducted Experiment 4, Teacher C conducted Experiment 5, and Teacher D conducted Experiment 6. The following results comprise information collected by all teachers. Results for individual teachers are reported when there is a point of interest specific to individual teachers.

(1) *Difficulties using iSTART*

To determine the ease or difficulty with which teachers use iSTART in the classroom, we analyzed the number and types of questions teachers asked iSTART researchers while administering the iSTART training. There were two iSTART researchers present for each training session; a computer expert for iSTART, and a postdoctoral psychologist specializing in reading strategy training. We recorded the frequency with which teachers asked questions about: 1) computer operation (i.e., "How does the student log on?"), 2) instructions/procedures for proceeding through iSTART (i.e., "What exactly is the character-agent asking the student to do here?"), 3) contents of

the texts used in iSTART (i.e., "What does the word/paragraph mean?"), and 4) technical difficulties or other questions (i.e., "What do I do if the program crashes?"). These frequencies were recorded for each of the three iSTART modules (Introduction, Demonstration, Practice)

Table 4 shows frequency of questions for each type of question for each module. The most commonly asked questions were computer-related. More specifically, most of the questions related to log-in problems (e.g., "How do I log a student on to the system?") and technical problems related to issues such as frozen screens and "dead" batteries (e.g., "Can you change the battery in the computer?"). Very few questions were asked concerning the instructions/procedures to be followed during training or about the meaning of the content of the texts used.

Table 4: Questions asked by teachers while administering the iSTART training

Question	Introduction	Demonstration	Practice	Total
Computer operation	18	12	6	36
Instruction /procedure	0	1	0	1
Text content	0	0	6	6
Technical difficulties	16	12	9	37
Other	3	0	0	3

(2) *Observations of iSTART training*

The second analysis focused on students' motivation for and enjoyment of the iSTART training, the difficulties encountered by students during training, and the difficulties encountered by teachers while guiding students through training. Observations were made by both the iSTART researchers and the teachers at the end of each training session using the following scale:

0 = No/none
1 = A little/few
2 = Quite/some
3 = For the most part
4 = Extremely/many

Table 5 shows the mean ratings from the iSTART researchers and the teachers (based on the 0-4 scale) regarding student motivation, enjoyment and difficulties. The results indicate that the iSTART researchers and teachers gave very similar ratings for students' motivation and enjoyment and also student and teacher difficulties. Whereas students' motivation and enjoyment is slightly above average, student and teacher difficulties are relatively low.

Table 5. Mean ratings of student motivation and difficulties with iSTART

Topic	iSTART team ratings Mean (SD)	Teacher ratings Mean (SD)
Student motivation	2.8 (0.5)	2.5 (0.8)
Student enjoyment	2.3 (0.6)	2.4 (0.8)
Student difficulties	0.3 (0.6)	0.7 (1.0)
Teacher difficulties	0.3 (0.6)	0.3 (1.0)

(3) *Observations of extended practice*

As with the training observations, two types of observation were conducted during the extended practice sessions: 1) observations by the University of Memphis iSTART researchers of teachers conducting the practice sessions; and 2) teachers' observations of the students' participation in the extended practice sessions.

The observations are based on the four teachers who participated in Experiments 3, 4, 5, and 6. Foremost, we compared teacher-guided practice to computer-based practice to establish the ways in which the two methods of practice are able to supplement iSTART. Hence, the data were divided into two categories: teacher-guided practice (the teacher-guided condition of Experiment 3 and the teacher-guided sessions of Experiment 7) and computer-based practice (all other conditions and sessions using the iSTART v2.0 Practice module).

Observations were made for all practice sessions for Experiment 6, but only selected practice sessions were observed in the other experiments due to practical constraints. That is, for Experiments 3, 4, and 5, we observed 2 classes in each experiment each week. For example, for Teacher A, Experiment 3 (who conducted live and computer sessions), we observed one teacher-guided and one computer-based practice session each week. We alternated the specific classes observed each week so that data was recorded for students in all classes across the extended practice period.

(4) *iSTART researcher's observations of extended practice*

The first analysis reports the observations by the iSTART researchers of the teachers. The purpose of the analysis was to evaluate the types of information that teachers provide to students during practice sessions. The analysis of the teacher-guided

training also provided an opportunity to investigate whether teachers themselves understand the strategies and are able to teach them effectively.

We used a checklist measure to rate the extent to which teachers provided effective instruction (e.g., instruction about the strategies included in iSTART). The following scale was used to record the teaching methods used.

(0) **Not observed:** Strategy was never observed
(1) **Rarely:** Receives isolated use and/or little time in the class/clearly not prevalent/emphasized component of teaching and learning across the class.
(2) **Occasionally:** Receives minimal or modest time or emphasis in the class. Not a prevalent/emphasized component of teaching and learning in the class.
(3) **Frequently:** Receives substantive time or emphasis in the class. A prevalent component of teaching and learning in the class.
(4) **Extensively:** Receives substantive time and/or emphasis in the class. A **highly** prevalent component of teaching and learning in the class.

Table 6 reports the mean score (based on the 0-4 coding system outlined above) for each teaching method used in the teacher-guided and computer-based extended practice sessions. The data indicate that teachers provided extensive instruction about self-explanation and the reading strategies during the teacher-guided practice sessions, but fairly infrequently for the computer practice sessions. Also, during teacher-guided practice, teachers focus more on content teaching, such as explaining word meanings, sentence meanings, and global text understandings (probably due to the interactive nature). Notes made by the iSTART researchers regarding the quality of the teacher-guided sessions and computer sessions indicate that during the teacher-guided sessions, teachers continuously talked about the strategies (e.g., explained meanings of paraphrasing and elaboration, and provided content-related information). Overall teacher-guided practice sessions seemed to offer an opportunity to deliver more instruction about strategies and topic contents than the computer practice, which may be important for bolstering effects of training.

Table 6: Mean score for methods used in the extended practice sessions

Teaching method	Teacher-guided practice Mean (SD)	Computer practice Mean (SD)
Self-explanation instruction	3.0 (1.4)	1.8 (1.7)
iSTART strategies instruction	3.2 (1.2)	1.3 (1.4)
Other reading strategies instruction	0.8 (0.9)	0.1 (0.6)
Word meanings	1.5 (0.9)	0.1 (0.3)
Sentence meanings	1.5 (1.6)	0.5 (1.3)
Whole text meaning	1.3 (1.8)	0.1 (0.3)
Teacher feedback	3.6 (0.9)	0.06 (0.3)
Peer feedback	0.5 (0.6)	0

Thus far, our data indicate that teachers were able to effectively conduct self-explanation practice sessions; that is, describe and offer feedback about the iSTART strategies. However, notes made by the iSTART researchers also indicated that teachers' input during teacher-guided practice was not necessarily correct and did not necessarily adhere to our teaching protocol. For instance, Teacher A was reported to provide incorrect information about the meaning of comprehension monitoring. Also, Teacher A sometimes focused on self-explaining texts at the paragraph-level as opposed to the sentence-level taught in iSTART. As indicated above, the protocol was for the teacher to follow the sentence-by-sentence method, but in general the teacher focused on paragraphs. Note, however, that is not necessarily a bad approach and may improve global understanding more so than explanation at the sentence level. Indeed, it is a modification we are incorporating into future versions of iSTART.

(5) *Teacher observations of extended practice sessions*

This analysis focused on teacher ratings of students' in the teacher-guided and computer-based practice sessions. Following the training protocol and using the following scale, teachers rated student motivation and enjoyment, difficulties encountered by students,) and difficulties encountered by teachers.

0 = No/none
1 = A little/few
2 = Quite/some
3 = For the most part
4 = Extremely/many

Table 7 shows the mean rating (based on the 0-4 scale) regarding student motivation, enjoyment and difficulties in the teacher-guided and practice sessions. The findings indicate that while ratings of motivation and difficulties were similar across the two types of practice sessions, levels of enjoyment were higher for the teacher-guided practice than for the computer-based practice.

Table 7: Mean scores for teacher ratings

Dimension	Teacher-led practice Mean (SD)	Computer practice Mean (SD)
Student motivation	2.8 (0.8)	2.5 (0.6)
Student enjoyment	3.1 (0.8)	2.4 (0.7)
Student difficulties	1.1 (1.2)	0.8 (0.9)
Teacher difficulties	0.9 (1.2)	0.3 (1.0)

To expand on the levels of enjoyment finding, notes taken by the iSTART researchers were recorded. The notes indicate that in the teacher-guided sessions, students were more likely to participate and be engaged in the self-explanation activity. The main criticism relating to the teacher-guided sessions was that some students struggled to produce self-explanations orally, or felt social pressure in the presence of

peers. On the other hand, there were reports of students becoming bored with the computer sessions and sometimes going “off task."

III. Improving the Performance and Usability of iSTART: Reading Skill, Text, and Response Mode Effects on Self-Explanations

A. Experiment 7: Text constraints and reading ability

In this study, we examined the appropriateness of feedback used in iSTART by evaluating the self explanations of both skilled and less skilled readers, including information contained in a particular sentence and the student’s prior knowledge, or information contained in different sentences. Skilled and less-skilled college students supplied verbal protocols after each sentence of two expository texts. Multiple regression equations were performed that predicted the number of nouns in the protocols that appeared in the (a) current sentence, (b) prior text, or (c) were from the students’ world knowledge. The predictor variables were characteristics of the text sentence and the reader’s prior knowledge of the sentence. The regression equations were computed separately for each student, and then the beta weights were averaged and tested against zero (see Table 8).

Table 8. Beta weights for predicting the number of content nouns

Reading skill/Predictors	Information type		
	Current sentence	Prior text	World knowledge
Less- Skilled Readers			
New Arguments	0.22*	-0.09*	0.1*
Prior Knowledge Overlap	0.06	-0.08*	0.02
Local Causal Connection	0.04	0.07*	-0.13*
Distal Causal Connection	-0.01	0.14*	-0.05
Argument Overlap	0.17*	-0.05	-0.09*
Skilled Readers			
New Arguments	0.22*	-0.06*	0.1*
Prior Knowledge Overlap	0.04	-0.17*	0.06
Local Causal Connection	0.02	0.04	-0.07*
Distal Causal Connection	-0.02	0.16*	-0.07*
Argument Overlap	0.17*	-0.01	0

Note: * $p < .05$

There are a number of findings from this study. Not surprisingly, when a sentence introduces new nouns or contains nouns that were previously mentioned, readers tend to include information from the current sentence in their verbal protocol. When a sentence contains causal connections, readers tend to include prior text in the protocol. However,

skilled readers tend to focus on distal causal connections, whereas less-skilled readers tend to include information from the prior sentence (local cause). When readers have prior knowledge of the sentence or when the sentences introduce new nouns, they tend not to include prior text information in their protocol. However, new nouns tend to elicit the readers world knowledge, perhaps in an attempt to explain the new concepts. Fewer nouns from world knowledge are included when there are causal connections in the sentence, or at least in the case of less-skilled readers, when the sentence contains previously read nouns.

Although the study revealed systematic relations between text characteristics and the information included in verbal protocols, skilled and less-skilled readers behaved similarly. Therefore, the data might not be useful for iSTART in distinguishing skilled versus less-skilled readers, but it might indicate general lack of comprehension or co-operation with iSTART. For example, if a reader is not including words form the current sentence when it contains new or overlapping nouns, then the reader might not be closely monitoring their comprehension or complying with iSTART.

B. Experiments 8a and 8b: Responding by Talking or Typing

Two experiments were conducted to examine mode of response. Experiment 8a used scientific texts while narrative texts were used for Experiment 8b. One set of analyses assesses the impact of talking versus typing on outcome measures. The second set focuses on the reading strategies that occurred in the think aloud protocols. The analyses of the outcome measures have been completed, but the analyses of the think-aloud protocols are ongoing.

With respect to the outcome measures, Experiment 8a included 10 short-answer questions. There were two types of questions. Text-based questions assessed memory for the explicit content, whereas, situation model questions tapped deeper understanding of the texts. The percentage of short-answer questions answered correctly was calculated for Experiment 8a and the percentage of story clauses recalled was calculated for Experiment 8b. With respect to Experiment 8a, A 2 (Reading Skill: Less Skilled VS Skilled) X 2 (Modality: Spoken VS. Typed) X 2 (Question Type: Text-base VS Situation Model) mixed ANOVA was conducted on the percentage of questions answer correctly. There was a main effect of question type such that performance on text-base questions (M = .45) was better than on situation model questions (M = .29), F (1. 47) = 47. 91, $p < .05$. There was a main effect of reading skill such that skilled readers performed (M = .46) better than less skilled readers (M = .28), F (1. 47) = 16. 45, $p < .05$.

The comprehension task for Experiment 8b was story recall. A 2 (Reading Skill: Less Skilled VS Skilled) X 2 (Modality: Spoken VS. Typed) mixed ANOVA was conducted on the percentage of story clauses that were recalled. No significant effects were found. Again most importantly, modality of the protocols did not have an impact on the comprehension of the passages.

The think-aloud protocols for both experiments are being analyzed using a scoring system to identify strategy. The system identified an overall quality score and the presence of four reading strategies; paraphrases, bridges, elaborations, and meta-cognitive statements. Paraphrases are instances that include stating the current sentence in ones own words and restating the current sentence. There are three levels for analyzing paraphrases. A "0" indicates that no paraphrase is present. A "1" indicates that the protocol contains a noun or noun phrase from the current sentence. A "2" indicates that the protocol contains a verb clause that has its basis in the current sentence including close synonyms. Bridges are instances where people bring up ideas from the prior text. Bridges can be local, containing ideas from the immediate prior sentence. A "0" indicates that the protocol does not contain a local bridge. A "1" indicates that the protocol contains a noun or noun phrase from the immediate prior sentence. A "2" indicates that the protocol contains a verb clause that has its basis in a clause from the immediate prior sentence. Elaborations are instances that contain concepts or ideas not mentioned in the text. A "0" indicates that no elaboration is present. A "1" indicates that the protocol contains a noun or noun phrase not present in the text. A "2" indicates that the protocol contains a main idea containing a verb clause from world knowledge.

Preliminary data analyses were conducted on a sample of 10 sentences (5 per text) for Experiment 8a. A mean strategy score was calculated for paraphrases, bridges, and elaborations for each participant. A 2 (Reading Skill: Less Skilled VS Skilled) X 2 (Modality: Spoken VS. Typed) X 3 (Reading Strategy: Paraphrase, Bridge, VS Elaboration) mixed ANOVA was conducted on the mean strategy scores for Experiment 8a. Reading skill was a between-participants variable, whereas Modality and Reading Strategy were within-participant variables. There was a significant Reading Skill X Strategy interaction, $F(2,96) = 3.48$, $p < .05$. Less skilled readers had higher strategy scores for paraphrases (M=1.21) than Skilled readers (M = .99). On the other hand, Skilled readers had higher strategy scores for bridges (M = 1.05) and elaborations (M = 1.13) than less skilled readers (M = .94 and M = 1.01 for bridges and elaborations, respectively). Most importantly, there was not a significant main effect of Modality or significant interactions with it (all $p > .10$). The analysis protocols for Experiment 8b are currently being conducted.

The results suggest that reading strategies are consistent regardless of the modality in which verbal protocols are produced. The only variable that had an impact on reading strategies was reading skill, which is consistent with prior research (e.g., Magliano & Millis, 2003). With respect to the outcome measures, modality did not appear to have an impact on performance in both Experiments. These results bode well for iSTART and other computer-based interventions and assessment tools that rely on having users type their verbal protocols rather than speak them.