THE DIFFERENTIAL EFFECTS OF SINGLE STUDENT RESPONDING AND WRITE-ON RESPONSE CARDS ON THE ON-TASK/DISRUPTIVE CLASSROOM BEHAVIORS OF ELEMENTARY STUDENTS AT-RISK FOR ACADEMIC FAILURE DURING WHOLE CLASS SCIENCE INSTRUCTION

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

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* * * * *

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ABSTRACT

The use of response cards to increase academic performance has been documented, (Narayan, Heward, Gardner, Courson & Omness, 1990; Gardner, Heward & Grossi, 1994) however, there has been little effort to examine the effects of response cards on social behaviors.

This study evaluated the differential effects of single student responding and write-on response cards on the on-task/disruptive classroom behaviors and the academic performance of elementary students at-risk for academic failure during whole group science instruction. A single student responding condition consisted of the teacher randomly calling upon students to answer questions during the daily lesson. Write-on response card condition involved all students responding to teacher posed questions by writing their answers on individual response cards and holding them up.

Results indicate that a functional relationship was demonstrated between the use of write-on response cards and increased on-task behaviors for all four of the targeted students, similar to the findings in the literature (Gardner, Bullara, Heward, Cooper & Sweeney, 1993). A functional relationship was not demonstrated between the use of write-on response cards or single student responding and the disruptive classroom behaviors of the target students. No functional relationship was demonstrated between the use of write-on response cards or single student responding and higher academic performance on daily quizzes. During both response cards and single student responding conditions each student needed to be prepared to respond to each teacher posed question, which may have maintained appropriate student classroom behavior across conditions.
Dedicated to my parents

TDTD
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CHAPTER 1

INTRODUCTION

Many of the above mentioned factors may contribute to an increase in the dropout rate for students. Students who are in danger of academic failure are given the label of being "at-risk" (Franklin & Streeter, 1995; Swanson, 1991). According to Franklin and Streeter, the students possessing poor academic skills create a cycle of failure by those low skills interfering with future academic success. Not only is academic success affected, but students at-risk for academic failure have also demonstrated poor social skills, such as inattention, behavior problems, and social problems with other students (Ekstrom, et al., 1986, 1987; McDill, et al., 1987; Hammack, 1987; Miller, et al., 1988; Reyes, 1989; Swanson, 1991).

According to Jones, Sheridan and Binns (1993) students at-risk for academic failure feel greater levels of stress and are more likely to develop behavioral or emotional disorders. Students at-risk for academic failure may demonstrate aggression, low rates of peer interaction, and inappropriate responses within a social context (Jones, et al., 1993; Franklin & Streeter, 1995; Swanson, 1991). Studies have shown that there is a relationship between social behaviors and school success (Cartledge & Cochran, 1993; Cartledge & Milburn, 1986; Wehby, Symons & Shores, 1995; Van Aker, 1993). As the dropout rate for students at-risk for academic failure increases, social consequences of significant impact are imminent. Levin (1972) identified seven social consequences of inadequate education: forgone national income, forgone tax revenues for the support of government services, increase demand for social services, increase crime, reduced political participation, reduced intergenerational mobility, and poorer levels of health.

Just as there are many factors identified for the prevalence of at-risk students, there are many suggestions for the remediation of poor academic and social performance. Once such suggestion is the early identification of students at-risk for school failure (McConnell, 1994). According to McConnell (1994):
Typically, early intervention services are provided to children who have developmental or other disabilities or who are at risk for disabilities due to poverty, homelessness, native language, parenting or caregiving experiences, or other known and unknown factors. (p. 75)

Vickers (1994) stressed the importance of involvement of the family with the school as one means of proactive intervention. Vickers notes that parental involvement results in higher academic achievement, more positive child behavior, and more effective schools.

DeRidder (1989) discussed interventions which would prevent elementary-level students from being pushed into the "dropout stream." First, the acceptance of worth by the child's first teacher(s) without any evidence of gender, race or ethnic bias. Second, school psychologist adding strategies to identify children potentially at-risk. Third, educators building successfully upon whatever experience the child brings to school. Fourth, providing a mandatory kindergarten experience for children. Fifth, development of a program of guidance and counseling during the early and middle years of the children's education. Sixth, discourage use of standardized tests for elementary levels. Seventh, developing democratically effective classrooms. Finally, maximizing school success and minimizing school failures.

Quality of classroom instruction can also have a significant impact a student's risk for school failure (Greenwood, Delquadri and Hall, 1984). Greenwood, et al., (1984) argued that delays in the academic competence of low socioeconomic students was due to instructional strategies that failed to engage the student's academic behavior for sufficient amount of time each day. This resulted in lower rates of daily academic behavior in the classroom and lower rates of academic growth and achievement (Greenwood, et al., 1984; Greenwood, et al., 1994.) Carta and Greenwood (1988) found that the extent to which the learners were academically engaged during instruction was the most important factor for academic achievement; the more the students were actively engaged in
instruction, the greater the academic gains. Rosenshine & Berliner (1978) also found that students who came into contact with curriculum materials and kept in contact with those materials made academic gains. Some tactics to increase the effectiveness of instruction are: effective instructional statements (Martens & Kelly, 1993), rate of presentation (Carnine, 1976), and indiscernible contingencies (Dunlap & Johnson, 1985).

Clear instructional statements by the teacher will help to establish appropriate stimulus control during lessons (Heward, 1994). A brisk rate of presentation will also promote student attending to instructional stimulus (Munk & Repp, 1994). Finally, when students cannot predict whether or not they will receive reinforcement after emitting a behavior, the targeted behavior remains at a level close to the level seen during constant reinforcement.

In addition, several instructional strategies have been shown to increase students' active responding to instructional stimuli, resulting in academic and social gains: choral responding (Sterling, Barbetta & Heward, 1993; Williams, 1993; Lingenfelter, 1990; Heward, Courson, & Narayan, 1989), peer tutoring (Thurston & Dasta, 1990, Vacc & Cannon, 1991; Polirstok & Greer, 1986), guided notes (Bullara, 1994; Courson, 1989; Hamilton, 1991; White, 1991), response cards (Gardner, Heward & Grossi, 1994; Gardner, Bullara, Heward, Cooper & Sweeney, 1993). According to Heward (1994) increased active student responding (ASR) has three benefits: ASR generates more learning, ASR provides important feedback to the teacher, and ASR is correlated with increased on-task behavior.

The use of response cards in one instructional strategy which has proven effective in improving the academic achievement of both at-risk and not at-risk students (Gardner, et al., 1994). Response cards are cards or signs that are held up by the students to display their response to a teacher-directed question (Heward, 1994.) Response cards can be preprinted, in which the student selects the answer that she/he will hold up from a
personal set of cards with preprinted answer on them (e.g. yes/no, true/false, colors, numbers), or write-on, in which the students write their answers on blank cards are boards which are erased after each question. The use of response cards to increase academic performance has been consistently demonstrated in many studies (Lenox, 1982; Hoagland, 1983; Wheatley, 1986; Narayan, Heward, Gardner, Courson & Omness, 1990; Gardner, et al., 1994; Sweeney, Gardner, Hunnicutt & Mustaine, 1992; Gardner, et al., 1993; Cavanaugh, 1992).

Although the use of response cards to increase academic performance has been explored, almost no research has studied the use of response cards to increase social behaviors of children at-risk. Bullara (1994) examined the effects of guided notes on social behaviors of students with severe behavior handicaps and found the students engaged in less disruptive and off-task behaviors during the use of guided notes.

**Purpose of the Study**

The purpose of this study is to systematically replicate the effects of Bullara (1994) who used an ASR strategy (i.e., guided notes) to improve the social behavior and academic performances of students. This study will differ from the Bullara study in that it: (a) will analyze the effects of the use of write-on response cards in place of guided notes on the appropriate/on-task behaviors of students, (b) will have students at-risk for academic failure as opposed to students with severe behavior handicaps as the participants, (c) use daily quizzes as opposed to bi-weekly quizzes to evaluate whether response cards produce improved academic performance, (d) involve general education students as compared to special education students, and (e) will be conducted in a different grade level (third and fourth grades.)

**Research Questions**

This study is designed to produce empirical data in response to the following questions:
1. During which condition, single student responding or write-on response cards, will students demonstrate higher percentages of on-task behaviors during science instruction?

2. During which condition, single student responding or write-on response cards, will students demonstrate lower percentages of disruptive behavior during whole class science instruction?

3. During which condition, single student responding or write-on response cards, will students demonstrate a higher academic performance on daily quizzes?

4. When asked her/his opinion after the study, which method of responding will students prefer, single student responding or write-on response cards?

5. When asked her/his opinion after the study, which method of responding will teachers prefer, single student responding or write-on response cards

Terminology

All special terms used in this study are defined are listed below:

**Appropriate classroom behavior:** Appropriate classroom behavior is included because the observers must distinguish between appropriate and disruptive classroom behaviors on the data recording sheet. Appropriate classroom behavior is defined as engaging in behaviors related to the current academic lesson. Classroom rules and expectations are followed by the student.

**At-risk:** At-risk students are judged by their teacher as being in danger of failing academically and/or being considered for special education placement due to poor grade point average, performance on standardized tests, and general response to the expectations of the school.

**Cover sheet:** Cover sheets are 8 1/2" x 11" plain white paper. These sheets were used by the students to cover their answers during quizzes.

**Disruptive classroom behavior:** Disruptive behavior is defined as attempting to or engaging others in behaviors unrelated to the current academic lesson. Disruptive
behavior is one or more of the following behaviors: engaging in conversation during teacher directed instruction, provoking others (e.g., laughing at, making faces at, throwing objects at or touching others), making sounds with voice, objects or actions (e.g., pounding on desk, non-specific auditory responses voicing disapproval, tapping, etc.).

**Daily science experiment:** The daily science experiments were illustrations of scientific principles being taught in the lecture. For example, in teaching about air pressure, an experiment involving the use of an egg and a bottle was used. Experiments were brief, lasting approximately 5 minutes, and performed so that all the students experienced the same phenomenon at the same time.

**Daily quiz:** The next day quiz covered the material presented during the previous lesson. They consisted of 7 recall questions.

**Dry-erase marker:** Dry-erase markers were used by students to write on the write-on response cards. The marks made using this marker were easily erased by rubbing lightly with a facial tissue.

**Instructional transparencies:** Transparencies were made from lecture outlines. The transparencies included all of the facts/concepts to be instructed during the lesson. Each lecture consisted of 3 to 4 instructional transparencies. The transparencies were made using water soluble markers. A different color marker was used to underline key words or phrases as the teacher lectures.

**Lecture outline:** Lecture outlines included 7-10 main ideas or concepts/facts for the teacher to present during the lecture to the class.

**On-task behaviors:** On-task behaviors are defined as when a student is engaged in activities related to the academic lesson. On-task is one or more of the following behaviors: remaining in seat during in-seat work time, eyes directed towards their work, the teacher or another student answering teacher-directed questions, head not resting on
desk, or working on projects not part of the current lesson, or other behaviors in which the student is directing her/his attention towards the person(s) providing information relevant to the lesson being taught.

**Off-task behaviors:** Off-task behaviors are defined as when a student is engaged in an activity other than those related to the academic lesson, but does not attempt to involve others in his/her behaviors. Off-task is one or more of the following behaviors: out of seat during in-seat work time, eyes directed away from their work, the teacher or another student answering teacher-directed questions, head resting on desk, working on projects not part of the current lesson, doodling or drawing, playing with objects, or other behaviors in which the student is directed away from the person(s) providing information relevant to the lesson being taught.

**Progressive disclosure:** A sheet of paper was used to progressively uncover and disclose each key concept/fact on the overhead transparency as it was being discussed by the teacher.

**Recall question:** A question stated in a manner that the student must recall the answer from his/her memory rather than recognizing the answer from choices presented.

**Student preference and opinion:** The students were read a questionnaire individually which asks their preferred mode of student responding and their opinion about the instruction they received (Appendix F).

**Systematic disclosure:** Systematic disclosure is the process by which the teacher used a separate paper (8 1/2" x 11") to cover the transparency so only the information currently being presented in the lesson or test is showing.

**Teacher preference and opinion:** The classroom teachers were given a questionnaire to read and write her responses to the questions. In addition, the teacher questionnaire asked about which condition, single student responding or write-on response cards, the teacher preferred to improve social behaviors of the students (Appendix H).
Write-on response cards: Write-on response cards are 9" x 12" white particle boards on which each student wrote in response to the teacher questions. Dry markers were used to write on the response cards. Once the teacher reviewed the student's answers by simultaneously having the students hold up their cards, the students were instructed to erase their answers.
CHAPTER 2

REVIEW OF THE LITERATURE

This is a review of the literature on the social behaviors and academic achievement of students academically at-risk. Included in the literature review are strategies that positively effect students' social and academic performance in the classroom, instructional strategies for increasing academic achievement and active student responding during instruction, as well as other related research.

Students At-Risk

Although the population of students determined to be at-risk is growing, there is considerable variability in the definition of students at-risk (McLaughlin & Vacha, 1992; Hammack, 1987). According to Kauffman, Wong, Lloyd, Hung and Pullen (1991), "...the phrase 'at-risk' emerged from argot of actuaries and epidemiologists and entered the vernacular of educators." (p. 7) Ronda and Valencia (1994) caution that the notion of being labeled at-risk tends to overlook the students themselves while focusing on the presumed shortcomings of the individual, while Lecompte and Dworkin (1991) suggest the term at-risk is not meaningless, but should no longer be used as a diagnostic tool, serving instead as a meaningful argument of proactive interventions.

Richardson, et al. (1989) identified four categories of children at-risk: readily identifiable (possessing physical, cognitive, or emotional conditions that lead to academic problems in the regular classroom, such as brain damage or blindness; severe (having family or background circumstances that make it extremely difficult for the school to
provide adequate instructional programming); context dependent (having sensitivity to classroom and school settings and seen as at risk by some educators, but not by others); and masked (having the ability to adapt well to classrooms socially, and so often not diagnosed as having learning problems resulting in not being provided with needed services). Unclear are the distinctions between students at-risk and those with disabilities. In fact, the definition may vary across districts, schools and/or classrooms (Winfield, 1986). Wetzel (1987) identified special education students as being significantly more likely than non-disabled students to come from low-income, single-parent families with heads of households who have relatively little education. Lombardi, Novatny, and Odell (1990) found a greater percentage of students having a categorical label associated with special education and who were enrolled in general education classes had a higher at-risk score than the other students enrolled in the same classes. The term "at-risk", as it is used in this study, refers to students who are: 1) doing so poorly in their academic work that they are in danger of failing academically, 2) being referred for special education placement, and/or 3) demonstrating behavior patterns associated with people who tend to drop out of school.

Characteristics of At-Risk Students

Students at-risk for academic failure are at an increased risk for societal failure (Franklin & Streeter, 1995; Swanson, 1991; Cartledge & Cochran, 1993). As the gap in basic skills widens for students at-risk with increasing age, so does the gap in academic competence, standard of living, and quality of life (Rumberger, 1987; Wehlage & Rutter, 1986; Barber & McClellan, 1987; Hahn, 1987). This gap then becomes intergenerational (Greenwood, et al., 1994). As Skinner (1984, p. 953) described, "A culture is punished by its failure or by other cultures which take its place in a continually evolving process." Dropout rates vary widely among social groups, being higher for members of racial, ethnic and language minorities, for men, and for persons from lower socioeconomic
status (Franklin & Streeter, 1995; Rumberger, 1987). Dropout rates also vary widely among school systems. Wehlage & Rutter (1986) found that some inner city schools report dropout rates of 40-50 percent.

The varied definitions of the term at-risk and exactly who is or becomes a dropout result in difficulties in determining the actual dropout rate (LeCompte & Dworkin, 1991). The dropout rate is higher in urban schools, public schools, for minority students, students from low socioeconomic status, low achievers, poor readers, students who have discipline problems, and students who are frequent truant (LeCompte & Dworkin, 1991; Reyes, 1989, McLaughlin & Vacha, 1992; Miller, et al., 1988; Vickers, 1994).

Recently passed legislation has placed an emphasis on higher standards of academic performance by students (Underwood, 1989), and increased interest in preventing academic failure for at-risk students (Self, Benning, Marston, & Magnusson, 1991; Miller, et al., 1988; O'Sullivan, & Tennant, 1993; Dunlap, Kern-Dunlap, Clarke, & Robbins, 1991; Farmer & Payne, 1992). Early identification and remediation is one development (Vickers, 1994; Wehlage, 1989). The difficulty lies in the fact that the causes of students dropping out of high school are numerous. Different reasons are reported by those who left school before graduating. Such reasons include school-related issues, family economic issues, and social issues such as pregnancy or marriage (Franklin & Streeter, 1995; Rumberger, 1987).


A number of studies also suggest temperament factors are associated with being at-risk, (Lambert & Windmiller, 1977; Hall & Keogh, 1978; Pullis & Caldwell, 1985.)
Payne & Payne, (1989) identified at-risk students as learners not achieving their potential or not meeting teacher expectations. At-risk students have been historically referred to as "underachievers," "underprivileged," "disadvantaged," or "culturally deprived" (Swanson, 1991). Other factors associated with at-risk students are intellectual, cultural and experiential deprivation, social and personal conflicts, behavioral deficits and learning disability (Stevens & Pihl, 1982, 1987). At-risk students have poor strategies for achieving success and heightened anxiety (Stevens & Pihl, 1982.)

Studies have indicated the following variable as being associated with at-risk for academic failure: both the parents and dropouts are often from society's socioeconomic underclass or from a diverse racial or ethnic group, the families typically live in poverty, increasingly headed by single parents, many parents are themselves dropouts, and other home factors (Rumberger, 1987; DeRidder, 1989; McLaughlin & Vacha, 1992; Miller et al., 1988; Vickers, 1994).

Demographic factors. According to Ramirez (1988) the United States is experiencing a demographic shift. By the turn of the century, as much as 40 percent of students enrolled in public schools will be from ethnically diverse backgrounds (e.g. African-American, Hispanic, Asian and Pacific Islander and Native American). Most of these ethnically different student populations are disproportionately represented among students experiencing school failure, and other negative circumstances, such as poverty, poor health care, or unstable home environments which contribute to their lack of success in school. As previously stated, dropout rates vary among social groups, being higher for members of racial, ethnic and language minorities, for men, and for persons from lower socioeconomic status. In 1984, the dropout rate for white males, ages 18 to 19 years old, was 15.8 percent; white females, 14.0 percent; black males, 19.7 percent; black females, 14.5 percent; Hispanic males, 26.2 percent; and Hispanic females, 26.0 percent, (Rumberger, 1987).
In 1995, Lucking and Manning (1995) reported increasing percentages of students are scoring below grade level in general. They report if you take into consideration both sexes and all races, 30.8% of 12 to 14 year olds scored below their chronological grade level. The National Center for Education Statistics Methodology Report (1995) defined a dropout as a student who had been enrolled at any time during the previous school year, did not graduate and was not enrolled October 1 of the current year. The 1991-92 school year was the first year for which states reported school district level data in the numbers and types of dropouts in the Common Core of Data Agency Universe Survey. The national statistic for dropouts showed 56% of students in grades 9-12 who dropout are male, 44% female; 1.8% American Indian/Alaskan Native; 2.4% Asian Pacific; 23.8% African American; 21.2% Hispanic; and 50.8% Caucasian. Specifically, Ohio reported 59.2% male, 40.8% female; 0.2% American Indian/Alaskan Native; 0.6% Asian Pacific; 17.5% African American; 2.3% Hispanic; and 79.4% Caucasian.

The dropout rate can vary widely among school districts as well. An example given by Rumberger (1987) is the dropout rate for the 63 Chicago high schools varies from a low of 10 percent to a high of 62 percent.

Family related factors. Rumberger (1983) states that family background is a strong predictor of dropout behavior. Increasingly, students at risk are from single parent families. Many of the parents are dropouts themselves, (DeRidder, 1989). For children at-risk, higher rates of parental illiteracy and poor parenting skills may contribute to poorly developed listening vocabulary which may lead to inadequate reading skills, (Weisberg, 1994; Hart & Risley, 1992). Families which have a limited or no English proficiency may have children at greater risk of academic failure (Arreaga-Mayer, Carta, & Tapia, 1994). According to Wallace & Kauffman (1986) other family related factors include family relationships, social class discrimination, sex role stereotyping and expectations of subcultural groups.
**Peer related factors:** Many dropouts have friends that have also dropped out of school. The educational aspirations and expectations of peers are generally related as well. Rumberger (1987) adds that the extent to which a student's peers influence their decision to dropout remains unclear.

**School related factors:** Many of the factors associated with dropping out of school can be manipulated by the school districts themselves. Poor academic achievement in school, as measured by grades, test scores, and grade retention is one such factor, (Ekstrom, et al., 1986; Wehlage & Rutter, 1986; Rumberger, 1987). Behavior problems in school are associated with being at-risk for academic failure. Behavior problems associated with school problems and dropping out include absenteeism, truancy, and discipline problems, (Jones, et al., 1993; Swanson, 1991; Wehlage & Rutter, 1986). Greenbaum & Turner (1989) state that the National School Safety Center reported that approximately 28,200 students and 5,200 teachers are physically attacked in secondary schools each month. An increased number of students come to school unprepared to meet the social and academic demands of the school setting (Van Aker, 1993). Other school-related factors include the organization of the schools themselves, leadership, teachers and instructional methods (Fine, 1986; Rumberger; 1987, Brophy; 1979).

**Economic factors:** Socioeconomic status plays a major role in the dropout rate. According to Rumberger, (1987), about 20% of the dropouts left school because they felt they had to work to help their families. Families of at-risk students usually have a lower socioeconomic status and live in poverty, or close to it, usually obtain their income from low-skilled jobs or government sources, (Franklin & Streeter, 1995; Swanson, 1991; DeRidder, 1989; Ekstrom, et al., 1986).

**Individual factors:** Many studies have found that dropouts experience a lower level of self-esteem and less sense of control over their lives than non at-risk students. There is a prevalence of poor attitudes about school along with low occupational and educational
aspirations (Franklin & Streeter, 1995, Swanson, 1991; Rumberger, 1987; Ekstrom, et al., 1986; Wehlage & Rutter, 1986.) Pregnancy and leaving school to get married are also contributing factors, (Franklin & Streeter, 1995, Swanson, 1991; Rumberger, 1987; Ekstrom, et al., 1986.)

**Special Education Placement**

Students at-risk often demonstrate characteristics defined under special education categories. Many times, the distinctions between students at-risk and those with disabilities remains unclear. In fact, the definition may vary across districts, schools and/or classrooms (Franklin & Streeter, 1995, Swanson, 1991; Winfield, 1986). In their review of the Kappan study, Lombardi, et al., (1990) found that at-risk students were defined by educators' estimates, including such things as having attempted suicide, having been arrested, having parents with negative attitudes toward school, having siblings who have dropped out, having been retained in school, having been suspended, or having grades below a "C." Of the 22,018 elementary and secondary school students enrolled in fourth, seventh and tenth grades, 64 percent who met the criteria for being at risk were also categorized as being learning disabled. They found that only 22 percent of the regular school population was at-risk, while approximately 63% of special education students were considered at-risk.

**Social Behaviors**

Students at-risk for academic failure often demonstrate poor social behaviors, including aggressiveness, failure to comply with teacher directions, or loss of control, absenteeism and/or truancy (Franklin & Streeter, 1995, Swanson, 1991; Wehlage & Rutter, 1986; Stevens & Price, 1992). Jones, et al., (1993) discussed as students at-risk for academic failure feel greater levels of stress, the likelihood of developing behavioral or emotional disorders increases. Students at-risk may demonstrate aggression, low rates of peer interaction, and inappropriate responses within a social context (Jones, et al,
According to Wallace & Kauffman (1986) students with social problems often identify feelings of low self-esteem, incompetence, inadequacy and worthlessness. Students at-risk for school failure often have problems with peer relationships, and/or teacher and parent relationships. Stevens & Price (1992) cite some of the following reasons for children at-risk demonstrating poor social behaviors; children who are homeless may be aggressive because they are trying to stake a claim for something or to counter feelings of lack of self-control, or resist forming close friendships because of their present situation of homelessness. Also, children with prolonged exposure to lead often display aggressive and anti-social behaviors.

In describing the importance of appropriate social behaviors, Wallace and Kauffman (1986) stress that social-behavioral development is linked to a student's acquisition of academic skills. If a student has poor social skill behavior, the student's chances for success in school is limited. Numerous programs have been developed to improve the social skills of students. Included in these are self-management training, specific social skills training programs such as The Walker Social Skills Curriculum; RECESS (Reprogramming Environmental Contingencies for Effective Social Skills), and ASSET: A social skills program for adolescents. These programs include videotaped social skills curriculum along with printed material to teach social skills through modeling, explanation, discussion and practice.

There have been some attempts by researchers to connect the social skill development with the academic performance of students. Cartledge and Milburn (1986) looked at the relationship between social skills and academic achievement. They contend that when a student is reinforced for academic performance, the social behavior that allows for the successful completion of the academic response is also reinforced. Del'Homme, Sinclair and Kasari (1994) discussed preschool teachers perceptions of skills necessary in
Kindergarten. These skills included staying on task, initiating to peers, assisting others, sharing, on-task behavior and following directions.

Nelson, Smith, Young, and Dodd (1991) conducted a review of the literature and found that self-management procedures can be used to promote the social and academic behaviors of students who demonstrate poor social behaviors.

Behavioral momentum, the tendency for behavior to persist following a change in environmental conditions (Mace, Hock, Lalli, West, Belfiore, Pinter and Brown, 1988) has been used to increase compliant responding with students demonstrating behavior problems. According to Mace, et al. (1988) the greater the rate of reinforcement, the greater the behavioral momentum. A sequence of commands with which the subjects were likely to comply were given immediately before giving a low-probability request. In each of five experiments Mace, et al. (1988) conducted with children demonstrating behavior problems, the high-probability command sequence resulted in a momentum of compliant responding that continued following a low-probability request.

Cartledge and Cochran (1993) suggest teaching cooperative learning behaviors to students with behavior problems which consists of social modeling, behavior rehearsal and reinforcement. Also suggested is the need to program a cooperative learning environment by providing explicit and systematic instruction for the desired operant behaviors. Other researchers have found appropriate academic responding may lead to improved social behavior (Gardner, et al., 1993; Bullara, 1994).

Programs for At-Risk Students

There are many different programs being implemented to assist students at-risk for academic failure. Included in these are Chapter 1 programs (remedial academic pull out programs to improve academic performance of at-risk students) (Madden & Slavin, 1987; McLaughlin & Vacha, 1992; Ellson, Harrison, & Barber, 1968; Dorval, Wallach & Wallach, 1978), Computer-Assisted instruction (using personal computers as a tutor
instead of another person) (Madden & Slavin, 1987; McLaughlin & Vacha, 1992),
Special Education services (Katsiyannis & Conderman, 1994; Madden & Slavin, 1987;
McLaughlin & Vacha, 1992), Classwide Peer Tutoring, (Hall, Delquadri, Greenwood, &
Thurston, 1982; Cooke, Heron, & Heward, 1983; Muirhead & McLaughlin, 1990),
Direction Instruction of basic skills, (Englemann, Becker, Carnine, & Gersten, 1988;
Kinder & Carnine, 1991), Precision teaching, (Lovitt, 1989; White & Haring, 1980),
Personalized System of Instruction (PSI), (McLaughlin & Malaby, 1975; and
McLaughlin, 1991), and various programs specifically designed by school districts for
their school systems (McLaughlin & Vacha, 1992).

Chapter 1 Programs. Chapter 1 programs are pull out programs for low-income
children that are designed to improve academic performance. One broad category of
Chapter 1 programs are diagnostic-prescriptive programs. In these programs, students
who are identified through testing programs are given instruction in another setting apart
from their regular classrooms (Madden & Slavin, 1987; McLaughlin & Vacha, 1992).
Project Conquest, a diagnostic-prescriptive program in East St. Louis which provided
services to groups of six students found the Chapter 1 students outgained a control group
of students in grades 1 through 6. Although some programs show consistent gains and
can be effective, (Madden & Slavin, 1987; McLaughlin & Vacha, 1992), others resulted
in relatively small gains (Madden & Slavin, 1987; McLaughlin & Vacha, 1992).

Another broad category of Chapter 1 programs is tutoring programs. Many tutoring
programs have been found to have profound effects for at-risk students academic
achievement. Professional tutors, trained teachers and paraprofessionals are used in the
tutoring sessions. In a program in Dade county, Florida (Training for Turnabout
Volunteers) middle school students tutored elementary students deemed at-risk in reading
and math, receiving credit for their tutoring. The students selected as tutors had to read
and compute math problems at a fifth grade level, allowing more students to participate
as tutors. A training program consisting of training in specific subject matter, learning skills in tutoring, and spending one day in five in group supervision learning these skills was implemented to ensure proper training of the student tutor volunteers. Results showed that when continued training was received, the tutors and tutees made significant gains. Another program developed in Dade county, Florida, the School Volunteer Development Project, used adults as tutors working with at-risk students in grades 1 through 6, 30 minutes per day, four to five days per week. Results showed students gained .50 standard deviations more in reading and 1.1 standard deviations more in math than untutored students. (Madden & Slavin, 1987; McLaughlin & Vacha, 1992).

Programs involving paraprofessionals (Programmed Tutorial Reading, Wallach Tutorial Program, and The Prevention of Learning Disabilities program) all showed gains over the nontutored students although none of the tutoring programs have presented long-term follow-up data regarding program effects (Ellson, Harrison, & Barber, 1968; Dorval, Wallach & Wallach, 1978; Madden & Slavin, 1987; McLaughlin & Vacha, 1992).

Computer-Assisted Instruction. Computer-Assisted Instruction (CAI) involves the use of a personal computer or mainframe as the tutor instead of another individual. Through the use of the computer, student needs can be evaluated, progress can be rewarded, and student progression can be monitored (Madden & Slavin, 1987; McLaughlin & Vacha, 1992). CAI program results have shown positive gains.

Special Education Services. The Individuals with Disabilities Education Act (IDEA) of 1990 provides educational rights for individuals with disabilities. Section 504 of the Rehabilitation Act of 1973 also ensures specific educational rights (Katsiyannis & Conderman, 1994; Yell, 1995). According to Katsiyannis and Conderman (1994):

The full impact of Section 504, however, is just now being recognized due to the recent interest of the Office of Civil Rights (OCR) and the Office of Special Education and Rehabilitation
Services (OSERS) in (a) implementing the mandate of the least restrictive environment, (b) assuring access to educational opportunities for students with Acquired Immune Deficiency Syndrome (AIDS), and (c) meeting the educational needs of the increasing numbers of at-risk and other students who qualify for services under Section 504 (NASDSE, 1991). (p. 311).

Special education services are being provided for students at-risk of academic failure. According to McLaughlin & Vacha (1992) teachers and principals view special education as an appropriate interventions for at-risk students.

**Classwide Peer Tutoring.** One of the most widely replicated tutoring programs is classwide peer tutoring. Classwide peer tutoring has been successful across many areas of the curriculum and across grade levels (Miller, Barbeta, & Heron, 1994). According to McLaughlin & Vacha (1992), it has been successful with Chapter 1 (Hall, et al., 1982), special education (Cooke, Heron, & Heward, 1983), and regular education students (Muirhead & McLaughlin, 1990). Classwide peer tutoring was originally developed at the Juniper Gardens Children's Project (Delquadri, Greenwood, Stretton, & Hall, 1983) to increase academic responding time and improve academic achievement.

Classwide peer tutoring involves the use of the entire class with the peer tutoring process. All students take turns serving as the tuto and tutee within one session. King-Sears and Bradley (1995) implemented a classwide peer tutoring program for spelling in a classroom which included typical students, gifted students, students with learning and behavioral problems, students identified as needing special education, and students identified as at-risk for school failure. Results indicated the greatest gains for students who were at-risk and who had mild disabilities. Spelling grades before CWPT were "B+", "B" and "C-" for students categorized as high, typical and at-risk/mildly disabled and after CWPT, the grades were "A", "A", and "B+."
Direct Instruction of Basic Skills. By learning to sequence instruction, present new concepts directly, provide modeling, provide examples, guided repeated practice, testing for mastery, programming for discrimination and review, teachers can increase the academic success of their students (Gersten & Carnine, 1983; Englemann, et al., 1988). Direct Instruction emphasizes the antecedent stimuli, which differs from other approaches which emphasize the consequence (Kinder & Carnine, 1991). According to Kinder and Carnine, (1991), there are four instructional design principles of Direct Instruction that are common to all Direct Instruction materials: explicit teaching of rules and strategies: every step in applying rules and problem solving is taught, example selection: examples are carefully selected that vary on their relevant attributes but have a “sameness.” For example, the rules for adding suffixes is the essential sameness, but providing a variety of words for which the rules apply and don’t apply will help to allow the students to generalize the rule or strategy, example sequencing: examples and matched nonexamples are presented back to back, creating minimally different pairs, and covertization: in order for the students to work independently and automatically, the overt steps are systematically faded so that the strategies become more covert.

Project Follow Through, implemented by the U. S. Office of Education in 1968, was a longitudinal study which included over twenty different approaches to teaching. It involved teaching students economically disadvantaged in Kindergarten through third grades. Over 7,500 students from 170 communities participated in the project. The major objective of Project Follow Through was to bring the academic achievement of economically disadvantaged primary grade students up to the national median. Abt Associates conducted an independent evaluation of the project and found that Direct Instruction was the most effective teaching method for skills in mathematics, reading comprehension and language (Gersten & Carnine, 1983; Meyer, Gersten & Gutkin, 1983; Gersten & Keating, 1987). Kinder and Carnine (1991) found other results: students
beginning Direct Instruction in Kindergarten had a greater measurable and educationally significant benefit present at the end of third grade than those who began Direct Instruction in the first grade, the gains in IQ were significant and maintained through the third grade, Direct Instruction was effective with students who were at-risk for academic failure, follow-up studies of fifth and sixth grade students who received Direct Instruction in the primary grades maintained their average over comparison groups from local schools, junior and senior high school students who received Direct Instruction in the primary grades maintained their advantage compared to local peers, and Direct Instruction generalizes across time and populations.

Successful results from Project Follow Through resulted in the use of Direct Instruction with special education students. Maggs and Morath (1976) used the Distar Language program developed by Englemann and Osborne (1976) with students with moderate to severe retardation. Results indicated that the students involved in Direct Instruction scored significantly higher on the Stanford-Binet and gained 22.5 months in the 24 month instructional period. Direct Instruction has been used to increase the academic performance of students with learning disabilities (Lloyd, Cullinan, Heins, & Epstein, 1980; Lloyd, Epstein & Cullinan, 1981; Gleason, 1995), moderate to severe mental retardation (Horner & McDonald, 1982; Sprague & Horner, 1984), and students academically at-risk (Kauffman & Pullen, 1989; Becker, 1977; Becker & Carnine, 1980; Gersten, Becker, Heiry, & White, 1984).

**Precision Teaching.** Developed by Ogden Lindsley (1972) around principles of operant conditioning and experimental analysis of behavior methods (West, Young, & Spooner, 1990) precision teaching involves the collection of rate data, through which instructional and intervention decisions are made (Liberty & Paeth, 1990; Howell & Lorson-Howell, 1990), as well as the use of timed measurements and standard celeration charts of student performances on practice and instructional activities (Binder, Haughton,
Fluency, goals and aims (proficiency levels), are important features of precision teaching (Koorland, Keel & Ueberhorst, 1990). Precision teaching techniques have proven effective in improving the academic performance of students at-risk of academic failure (Johnson & Layng, 1994; Lovitt, 1989; White & Haring, 1980).

**Personalized System of Instruction.** Personalized System of Instruction (PSI) can be adapted to a large area of curriculum with minimal training. Through use of written study questions, frequent use of quizzes over small units of materials, allowing students to retake quizzes and exams, and use of remedial tutoring, students at-risk for academic failure can make increases in their academic achievement. Research has shown that the use of PSI can be successful with at-risk elementary school students (McLaughlin & Malaby, 1975) and special education students (McLaughlin, 1991).

**Teaching Strategies**

Establishing stimulus control and manipulating antecedents to maintain that stimulus control is very important for developing effective instruction (Martens & Kelly, 1993; Cooper, et al., 1987). There are some key variables available in establishing this control.

**Instructional Technique**

Research has identified many instructional variables characterizing effective teaching (Gettinger, 1988; Brophy, 1983; Kounin, 1970; Emmer, Evertson, & Anderson, 1980; Good, 1979).

**Instructional statements.** According to Martens & Kelly (1993) the type of instructional statement given by the teacher to the students plays an important role in establishing stimulus control. Atwater and Morris (1988) conducted a study focusing on variables related to teacher instruction and compliance with preschool children and found students engaged at the time of instruction were more likely to comply than students who were off-task when directions were given. Effective instructional statements are simple
and sequential and include demonstrations of sample problems (Heward, 1994; Martens & Kelly, 1993).

**Rate of presentation.** The rate of presentation by the teacher can establish stimulus control. Camine (1976) conducted a study involving two low achieving students who were frequently off-task during reading instruction. Slow presentation rates (i.e., 5 second pause before students answered) were compared to fast presentation rates (i.e., no pause). Results indicated that students off-task behaviors were decreased while academic performance and participation in the lesson increased. Research demonstrates a brisk pace of instruction produces higher rates of on-task student behavior (Evertson, Clements, Sanford, & Worsham, 1989; Courson & Heward, 1988; Heward; 1994; Williams, 1993; Lingenfelter, 1990; Heward, Courson, & Narayan, 1989; Shores, et al., 1993). Munk and Repp (1994) found the rate at which tasks or instructions are presented may function as a setting event affecting the probability that the task itself will produce problem behavior. The authors' report that instruction presented at a rapid pace increases task-related responses and more opportunity to respond and more opportunity for reinforcement.

**Indiscriminable contingencies.** Indiscriminable contingencies are those contingencies which focus on the consequence in place of the antecedent stimuli. Indiscriminable contingencies make it less likely that the student will be able to predict when a behavior should occur. If the contingencies are predictable, the behavior change may not occur (Heward, 1994).

Dunlap and Johnson (1985) conducted a study with autistic children to compare the effects of two different methods of supervision on the on-task and productivity behaviors of the participants. Under predictable supervision (the supervisor was present, but later left the area and did not return). The unpredictable supervision condition required the supervisor to enter and leave the area intermittently. Results showed that student on-task
and productivity behaviors were high under both conditions when the supervisor was present, but productivity decreased during the absence of the supervisor. When the students could not predict the presence or absence of the supervisor (unpredictable supervision conditions), on-task and productive behaviors remained at consistently high levels.

One indiscriminable contingency used in research studies is the use of a pre-made, random list of students in the classroom participating in the study (Gardner, et al., 1994; Narayan, et al., 1990). The use of a random list of names to call upon students to answer questions reduces the ability of students to discern when they will be asked to answer questions.

Effects of reinforcement. Both continuous and intermittent schedules of reinforcement are frequently used in the classroom. Continuous reinforcement is used when students are first learning a behavior, and intermittent reinforcement is used to increase fluency of a new behavior or maintain established behavior (Heward, 1994; Cooper, et al., 1989). Research has also indicated that the behavior of one individual may have an influence upon the behavior of another (Kazdin, 1979; Bol & Steinhauer, 1990). Shores, et al., (1993) identified several classroom influences on aggressive and disruptive behaviors of students with emotional and behavioral disorders; one such influence being rates of social reinforcement. Low rates of social reinforcement may increase the aversiveness of the classroom environment. Shores, et al., (1993) reports that student disruptions decrease as teacher rates of praise increase.

Academic Learning Time

Academic learning time (ALT) is "a measure of the time a student spends actively engaged in academically relevant materials that are moderately difficult (Heward, 1994). The concept of academic learning time developed from the Beginning Teacher Evaluation Study (Fischer, Berliner, Filby, Marliave, Cahen, & Dishaw, 1980). The
purpose of the Beginning Teacher Evaluation Study (BTES) was to identify teaching activities and classroom conditions that increase student achievement. Students in grades two and five were the participants for this research. Second grade students ranged from 62 to 123 minutes per day engaged in ALT and fifth graders ranged from 49 to 105 minutes per day engaged in ALT. Researchers found that student learning was positively correlated with the amount of time allocated for that content area, and that the amount of allocated time that students were actively engaged in academic tasks is positively associated with learning (Fischer, et al., 1980; Rosenshine & Berliner, 1978). Once weakness of ALT is, however, that ALT is a time-based measure, and cannot identify the actual number of learning trials in which the student participated during instruction (Heward, 1994).

Greenwood, Dinwiddle, Terry, Wade, Stanley, Thibadeau & Delquadri (1984) conducted research on ALT and found student engaged time doesn't enable the distinction of specific types of academic responses (Greenwood, et al., 1984; Heward, 1994). The concept of opportunity to respond was developed, accounting for both the instructional condition and the academic response.

**Opportunity to Respond**

Opportunity to respond is a term that was developed by Vance Hall and his associates at the Juniper Gardens Children's Project (Delquadri, Greenwood & Hall, 1979; Hall, Delquadri, & Harris, 1977; Hall, et al., 1982). Opportunity to respond (OTR) "has become the most widely used term in the behavioral literature to refer to active student participation during instruction." (Heward, 1994, p. 289). Opportunity to respond "is a measure of active student responding to instruction. OTR is an ecobehavioral measure of the interaction between: (a) teacher-formulated instructional antecedent stimuli (the materials presented, prompts, questions asked, signals to respond, etc.), and (b) their success in establishing the academic responding desired or implied by the materials"
(Heward, 1994, p. 289). The emphasis is on the instructional antecedent that evokes the occasion for the desired student response.

Code for Instructional Structure and Student Academic Response (CISSAR) is the observational system developed to precisely measure OTR (Delquadri, Greenwood & Hall, 1979). As many as 53 different setting or behavioral events across six different categories are observed and used to analyze the interactional effects of various academic activities, tasks, classroom structures, and teacher behavior with student responding (Greenwood, et al., 1979; Stanley and Greenwood, 1981; Hall, et al., 1982; Heward, 1994).

Research at The Juniper Gardens Children's Project has shown OTR an important variable in increasing academic achievement of students at risk (Delquadri & Greenwood, 1981). Through use of the CISSAR observational system, Greenwood, et al., (1979) found that 75 percent of the day was assigned to instruction in academic subjects, yet only 25 percent of the day was spent with students actively responding to instructional materials. Other studies produced similar results (Hall, et al., 1982; Stanley & Greenwood, 1983).

**Active Student Responding**

According to Heward (1994, p. 286), active student responding (ASR) "can be defined as an observable response made to an instructional antecedent." Included in active student responding are asking and answering questions, spelling, writing, oral reading, solving math problems, spelling, and measuring objects (Courson & Heward, 1988). Like opportunity to respond, ASR emphasizes the three term contingency of antecedent behavior and reinforcement. A frequency count of the number of academic responses emitted within a given period of instructional time is the basic measure of how much ASR takes place. Research has shown that ASR shows a gain in academic performance over passive student responding (Greenwood, et al, 1984; Narayan, et al.,
There are three major benefits of increasing ASR during instruction (Heward, 1994). These include: ASR generates more learning, ASR provides important feedback to the teacher, and ASR is correlated with increased on-task behavior. Characteristics of ASR include short answers (students have to briefly respond to the question presented), only one correct answer, and questions are presented at a fast pace (Heward, Courson, & Narayan, 1989).

Several strategies which show the characteristics of increased ASR are: choral responding, peer tutoring, guided notes and response cards.

**Strategies to Increase Active Student Responding**

**Choral Responding**

The use of choral responding as means to increase ASR entails each student in the class responding orally to the instructional antecedent in unison. Choral responding is best suited for teacher-posed questions which require one to three word responses from the students (Courson & Heward, 1988) Guidelines for using choral responding include:

1. Provide clear directions and model one or two trials
2. Provide a thinking pause as needed.
3. Use a clear, consistent cue to signal students to respond.
4. Provide feedback for the "majority response".
5. From time to time, randomly call on individual students.
6. Maintain a lively pace.

Choral responding can be used effectively in a variety of subjects and settings and with a diversity of student populations. Morgan (1987) used choral responding during small-group instruction to improve reading skills of students with behavioral disabilities. Results indicated that both students' academic performance and on-task behavior increased with a shorter intertrial interval. Bosch (1988) used choral responding with Chapter 1 reading program students to increase accuracy of sight word vocabulary.
Results indicated student academic achievement made gains with a high rate of ASR to each word. Lingenfelter (1990, Experiment I) used choral responding in a first grade general education classroom in a suburban school to determine the effects of choral responding (CR) vs. hand-raising (HR) on ASR rate per minute, on-task behavior and sight words read correctly on daily tests. Results indicated that ASR rate and on-task behavior was higher during choral responding, and there was a mixed result on sight word tests for students. Lingenfelter (1990, Experiment II) used the same procedures with a special education class (DH students) in an inner city elementary school classroom. Results indicated that the ASR rate was higher for all students, on-task behavior was higher for three of the four participants, and five out of eight participants had higher mean scores for correct sight word vocabulary identification on words taught with choral responding. Sterling, et al., (1993) used choral responding in a special education classroom (DH and SLD students) in a suburban elementary school for the number of health facts stated correctly on daily tests. Results indicated that students scored higher using choral responding than an on-task approach to learning.

Peer Tutoring

Peer tutoring has proven to be an instructional strategy that can positively affect the academic and social behaviors of students (Thurston & Dasta, 1990, Vacc & Cannon, 1991; Polirstok & Greer, 1986). Researchers have found that peers can be used as a behavior change agent due to the frequent contact they have with one another (Jenkins & Jenkins, 1981; Polirstok & Greer, 1986). Peers can act as contingency managers and are exposed to the possibility of giving cues to the tutee peer in nontutoring situations (Sulzer-Azroff & Mayer, 1991). Peer tutoring can be formatted for use as classwide peer tutoring in which the entire class participates at the same time, each student assuming reciprocal roles of tutor and tutee (Greenwood, et al., 1984), cross-age in which an older student is paired with a younger student (Polirstok & Greer, 1986), small group in which
tutoring is used with selected students or a rotation of the entire class, one-to-one (selected students participate in one-to-one format), or home-based in which the parent or sibling acts as tutor (Thurston & Dasta, 1990).

According to Miller, Barbetta and Heron (1994) many teachers overlook one of the most powerful instructional sources, which is the students themselves. Students are readily available and can be highly effective. The use of peer tutors in classrooms have shown to increase students' on-task behavior (Heward, Heron, Ellis & Cooke, 1986), improve sight word vocabulary (Barbetta & Heron, 1991; Barbetta, Heron, & Heward; 1993), social skills (Ehly & Larson, 1976) reading (Delquadri, et al, 1983) and increase math skills (Thurston & Dasta, 1990; Vacc & Cannon, 1991).

Guided Notes

As students progress through the grade levels, more emphasis is placed on note-taking skills. Student taking accurate note during class and then study them at a later time score higher on tests than students who listen to the lecture and read the text or materials (Heward, 1994; Baker & Lombardi, 1985; Carrier, 1983). Students who do not possess effective note-taking skills find this form of instruction frustrating. Guided notes are lecture notes prepared by the teacher which contain cues and spaces in which to write the content information. The use of guided notes can train students to become effective notetakers and reduce the frustration experienced by the students (White, 1991). Although the student's own notes have the potential for increased ASR because they may write everything the teacher states in their notes, guided notes have shown to increase the ASR of students during whole class instruction by providing the student with a framework outline for important notes in which the student responds by writing the correct response in each blank as progressively disclosed by the teacher using overhead transparencies to accompany the lecture.
Courson (1989) used guided notes in a special class for students with severe learning disabilities and students academically at risk, in a suburban middle school, to study the effects of guided notes on social studies content and academic performance. Results demonstrated that all 19 students had higher mean scores on daily quizzes and bi-weekly quizzes when using guided notes.

Hamilton, (1991) used guided notes in a special classroom in a school for incarcerated juvenile offenders for social studies content and academic performance. Results replicated Courson (1989) when all 9 students had higher quiz scores during guided notes conditions.

White (1991) used guided notes in a special education classroom in an inner-city secondary school with 8 students with SLD. The percentage of lecture concepts/facts accurately recorded in students’ own notes and percent of correct items on a 14-item next-day quiz was examined. Results demonstrated the changes in each student's note-taking skills increased through use of guided notes.

Other researchers have demonstrated a positive effect of use of guided notes on quiz scores (Yang, 1988; Pados, 1989; Virgalitte, 1988), accuracy of student note-taking (Pados, 1989) and social behaviors (Bullara, 1994).

Response Cards

Another strategy that has been used to increase active student responding is response cards. Response cards can be preprinted, in which the student selects the answer that she/he will hold up from a prepared set of cards with preprinted answers (e.g. yes/no, true/false, colors, numbers), or write-on, in which the students write their answers on blank cards are boards which are erased after each learning trial. One advantage of response cards is that the teacher is able to see which students have the correct answer and which students are making errors.
Many studies have been conducted utilizing response cards as a means to increase active student responding and academic performance. Pappas (1994) studied the effects of handraising and preprinted response cards on academic achievement during math and reading instruction with full-day Kindergartem students. Student frequency of responding was greater with preprinted response cards (15.2) over handraising (1.2), and students scored more correct on daily quizzes during response card conditions over handraising.

Cavanaugh (1992) compared the effects of verbal and response card reviews during lesson closure on the academic performance of high school students, eight of whom had been formally identified as “at-risk.” Results indicated that students performed better on next-day quizzes that had been reviewed with response cards than with teacher verbal statements.

Lenox (1982) conducted a study using response cards with secondary students with developmental disabilities to teach employment application skills. Results indicated that students were able to effectively complete employment applications.

Hoagland (1983) conducted a study using response cards teaching driver's education to secondary students with SLD in a suburban school. Hoagland looked at the effects of response cards upon ASR rate, ASR accuracy, a 20-item test of traffic signs and laws, and three students who would take the Department of Motor Vehicles test three months later. A multiple baseline across two independent variables (write-on response cards and preprinted response cards) was used. Results indicated students were able to successfully pass the Ohio DMV test; two students on the first try and the third student passing on the third try.

Wheatley (1986) used response cards in a special education classroom in an inner city middle school with 9 students with developmental disabilities. With the experimenter serving as the teacher, the dependent variables were functional math (money-handling
skills); ASR rate, ASR accuracy and 5-item same-day quiz scores. An alternating
treatments design of 20-minute sessions was conducted using either hand-raising, in
which one student at a time was able to respond, or preprinted (true/false, and numerals)
and write-on response cards were used. There were 29 total sessions. Results indicated
an increased ASR rate with response cards over hand-raising, an increased accuracy with
response cards over hand-raising, and in increase in the academic performance on the
same-day quiz.

Narayan, et al., (1990) found an improved academic performance in a study using
response cards with fourth grade general education students in an inner-city elementary
school classroom during social studies. The first author served as the teacher during the
study. Dependent variables were ASR per session, ASR accuracy, and 10-item same-day
quiz scores. An ABAB design of daily, 20-minute sessions was used with hand-raising
or response cards used as the independent variables for 31 total sessions. Results were
increased ASR during response card sessions with no significant difference in accuracy
during instruction. indicated ASR per session: 19 of 20 students had higher mean quiz
scores during the response card lessons than during hand-raising lessons.

Gardner, et al., (1994) studied the effects of response cards with fifth grade
elementary school students in an inner-city school. Using science as the subject matter,
the dependent variables looked at in this study were ASR per session, ASR accuracy, a
16-item next-day quiz, and a 40-item bi-weekly review test. An ABAB design of 50
minute lessons conducted on a daily basis with either hand-raising or write-on response
cards was used for a total of 26 sessions. Results showed increased ASR per session
during response card conditions than during hand-raising conditions, a slight increase of
ASR accuracy during response card conditions than during hand-raising conditions, and
increased academic performance during response card conditions than during hand-
raising conditions.
Sweeney, et al., (1992) used response cards with social studies instruction in an inner-city general education classroom with five students, two being identified as academically at risk. Dependent variables studied were ASR per session, ASR accuracy, student preference for three modes of participation; and a 12-item next-day quiz. An alternating treatments design of hand-raising (HR), write-on response cards (WORC) and preprinted response cards (PPRC) (true/false) was followed by an ABAB design of write-on and pre-printed response cards for a total of 55 sessions. Results indicated an increase in ASR per session during preprinted response cards conditions than write-on response cards or hand-raising conditions, increased ASR accuracy during preprinted response cards conditions than write-on response cards or hand-raising conditions, and 25 of 26 chose write-on response cards as their preferred choice, preprinted response cards second, and hand-raising placed third most-liked method; quiz scores improved across conditions during the alternating treatment design and maintained during the ABAB design of the study.

Gardner, et al., (1993) employed the use of response cards for social studies in a fourth grade general education classroom in an inner city school. Three target students had histories of off-task and disruptive behaviors during group instruction. The classroom teacher served as the teacher during this study. The dependent variables studies were the percentage of observed intervals of off-task behavior and disruptive behavior of three target students. An ABAB design of daily, 20-minute social studies lessons was conducted with either hand-raising or write-on response cards as the experimental conditions for a total of 36 sessions. Results indicated clear functional relations between response card use and reduced off-task and disruptive behavior for all three target students.
Summary

In summary, students at-risk for academic failure are more likely to drop out of school than non-at-risk students for academic failure. Although many factors affect students dropping out of school, early intervention is a key variable in preventing students from dropping out by providing specific instructional strategies to improve their academic and social performance.

Many instructional strategies have proven to be effective in increasing the academic performance and social behaviors of students at-risk. Academic learning time, opportunity to respond, active student responding, and instructional strategies to increase ASR and their effects upon academic performance and social behaviors were reviewed. Research has indicated a functional relationship between ASR strategies and improved academic performance and social behavior among students at risk for academic failure.

Effective teaching strategies can be used in classrooms to establish and maintain stimulus control: instructional statements, rate of presentation, indiscriminable contingencies, and effects of reinforcement.
Chapter three details the methods used in this study. Included are the following: subjects, setting, experimenter and observers, experimental design, definition and measurement of the dependent variables and independent variables, reliability of data, procedural reliability, materials and procedures.

Subjects and Setting

Students who participated in the study were in a general education classroom in an urban elementary school (Figure 1). There were twenty-eight students in the third and fourth grade classroom, 16 boys and 12 girls. Parental and/or guardian consent was obtained prior to participation in the study (Appendix A). A cover letter was sent by the experimenter to the parent/guardian for the purposes of explaining the study and to obtain permission for their child to participate.

The entire class of twenty-eight students was given the opportunity to be involved in the daily instruction, and the daily quizzes. Students participating in the study were identified as either at-risk or non at-risk. Data was collected for all 28 students in the classroom on academic performance.

Four students were targeted for additional data collection for on-task and disruptive classroom behaviors during instruction. The four students were chosen by the principal, teachers and experimenter from those determined to be academically at-risk.
Student 1

Student 1 is a nine-year-old male, fourth-grade student. According to teacher records Student 1's academic performance indicated he was performing below classroom standards in several subject areas. Student 1 had below grade-level reading skills, and had been formally determined to be learning disabled. Because Student 1 demonstrated problems reading the questions to the quiz during the practice lessons (by raising his hand and verbally stating that he was having problems reading the entire questions on the quiz) the third observer read the quiz questions aloud to Student 1 and he wrote the answer to each question in the appropriate blank on the quiz form. Observations of Student 1's behavior prior to beginning the study revealed the following frequent behaviors during instruction: off-task, talking out, out of seat, aggravating others through verbal taunts and physically placing hands on peers.

Student 2

Student 2 is an 8 year-old male, third-grade student. Student 2's academic performance record indicated he was performing below classroom standards in several subject areas. Observations of Student 2's behavior prior to beginning the study revealed the following frequent behaviors during instruction: out of seat, talking out, disrupting peers during lessons through physical hands-on, off-task and aggravating peers with verbal taunts.

Student 3

Student 3 is a 9 year-old male, third grade student, having been retained after a previous school year. Teacher records of Student 3's performance indicated he was performing below classroom standards in several subject areas. Observations of Student 3's classroom behaviors prior to beginning the study revealed the following behaviors during instruction: physical aggression towards peers, talking out, non-compliance, off task and verbal aggression.
Figure 1. Classroom layout for the research study.

Note. Shaded areas are those areas at which the four students targeted for additional data collection on their on-task and disruptive classroom behaviors sat.
Student 4

Student 4 is an 8 year-old male, third-grade student. Teacher records of Student 4’s academic performance indicated he was performing below classroom standards in some subject areas. Observations of Student 4’s classroom behaviors prior to beginning the study revealed the following behaviors: non-compliance, verbal aggression, off-task, out of seat, aggravating peers by touching them or their belongings.

The students' regular classroom served as the site for this study. The elementary school is located in a working-class socioeconomic area of a large midwestern city.

Experimenter and Observers

The experimenter is a third-year doctoral student majoring in special education and applied behavior analysis at The Ohio State University. The experimenter has a bachelor of science degree in education and a master of arts degree in education both from The Ohio State University. The experimenter has ten years of public school teaching experience, seven of which were as a teacher of students identified as having a severe behavior handicap. During this study, the experimenter served as the teacher during all sessions.

A second-year Masters student majoring in special education at The Ohio State University served as the primary observer trained specifically in the correct observation procedures.

The regular classroom teacher served as the secondary observer trained specifically in the correct observation procedures prior to beginning the study. Another classroom teacher trained specifically in the correct observation procedures prior to beginning the study served as a third observer.

Training Procedures

All three observers for the study were trained simultaneously. First, the definition of the dependent variables was discussed in detail by the experimenter with all three
observers. The experimenter then gave the observers specific examples of classroom behaviors and asked each observer (in random order) to classify the behavior as on-task, off-task, appropriate, or disruptive classroom behaviors. Following the oral examples, a behavior checklist form was given to each observer (see Appendix J). The behavior checklist contained examples of classroom behaviors not previously discussed. The observers had to read the examples and identify the behavior as either on-task or off-task and either appropriate or disruptive classroom behavior. Observers marked their choice of behavior classification directly onto the checklist. Following completion of the behavior checklist, answers were discussed with the observers using an answer key to the checklist. Any discrepancies between the predetermined answer key and what the observer(s) marked as their answer was reviewed and discussed between the experimenter and the observers. Incorrect responses were changed with the observer knowing why the answer they indicated was not the appropriate choice. After the dependent variable definitions and the behavior checklist were reviewed, observers participated in two practice lessons in which they listened to the cued tape recording that indicated when to observe and record and marked their data on individual observational data collection sheets. Following each lesson, Interobserver Agreement data was calculated and reviewed with the observers by the experimenter.

The following training procedures were used for the primary, secondary and third observers, each of whom had a specific job during the observation of the students during data collection:

**Primary Observer**

The primary observer was responsible for collecting data on the on-task/off-task, appropriate/disruptive classroom behaviors of the four selected students, and the number of teacher prompts necessary to correct any inappropriate/disruptive classroom behaviors during instruction. Prior to beginning the study, the experimenter explained in detail the
definitions of the dependent variables to the primary observer (training sessions were conducted with all observers simultaneously). The primary observer was then given a short checklist on the identification of appropriate and disruptive behaviors and teacher prompts for redirecting/correcting inappropriate/disruptive classroom behaviors (Appendix J). Criteria for successful completion was 100% accuracy on the behavior checklist. Upon successful completion of the behavior checklist, the primary observer was trained on how to use the data collection sheet (Appendix D) along with the recorded cues to observe and record student behavior. Once the observers had been instructed on the data collection, she then participated in two practice lessons (along with the other observers), in which they collected data using the observation sheet and interval recording system. Observers had to reach a criterion level of at least 80% agreement during the practice sessions. Two of the three observers (secondary and third observers) had no experience collecting data using an interval recording system. Upon completion of the first two practice sessions, the minimum criterion level was not reached, (68% for the first practice lesson and 72% for the second practice lesson). As a result, two more practice trials were conducted until the criterion level was successfully completed. Three more practice sessions were needed to reach the criterion level of 80% or above.

Secondary Observer

The secondary observer was also responsible for collecting data on the on-task/off-task, appropriate/disruptive classroom behaviors of the four selected students, and the number of teacher prompts necessary to correct any inappropriate/disruptive classroom behaviors during instruction. Prior to beginning the study, the definitions of the dependent variables were explained in detail by the experimenter to the secondary observer (training sessions were conducted with all observers simultaneously). The secondary observer was then given a short checklist (identical to the checklist given to the primary observer) on the identification of appropriate and disruptive behaviors and
teacher prompts for redirecting/correcting inappropriate/disruptive classroom behaviors (Appendix J). Criteria for successful completion was 100% accuracy on the behavior checklist. Upon successful completion, the secondary observer was trained (along with the primary and third observers) on how to use the data collection sheet (Appendix D) along with the recorded cues to observe and record student behavior. Once the preliminary procedures were successfully completed, the secondary observer observed two practice lessons in which they collected data using the observation sheet and interval recording system. The secondary observer had no experience collecting data using an interval recording system. Upon completion of the first two practice sessions, the minimum criterion level was not reached, (68% for the first practice lesson and 72% for the second practice lesson). As a result, two more practice trials were conducted until the criterion level was successfully completed. Three additional practice sessions were needed to reach the criterion level of 80% or above.

**Third Observer**

The third observer helped Student 1 with his quiz by reading the quiz questions aloud to him while he wrote the answer to each question on the quiz form. The third observer was also responsible for collecting data on procedural integrity. The general procedures for the administration of the lesson were reviewed with the third observer by the experimenter by reviewing a scripted lesson. A procedural integrity checklist was then explained in detail by the experimenter to the third observer. The third observer was then trained in the use of the procedural integrity data collection sheet (Appendix I) and recorded data during two practice lessons. The third observer had no experience collecting data using an interval recording system. Upon completion of the first two practice sessions, the minimum criterion level was not reached, (68% for the first practice lesson and 72% for the second practice lesson). As a result, two more practice
trials were conducted, until the criterion level was successfully completed. Three additional practice sessions were needed to reach the criterion level of 80% or above.

Observational Drift

Observational drift was controlled for by reviewing the observation and data collection procedures with all three observers after the first week of data collection. The review sessions consisted of recalibration of the definition of the dependent variables with each observer (the experimenter verbally reviewing the definitions and asking each observer to orally identify what behaviors they were identifying under each dependent variable), readministration of the behavioral checklist (see Appendix J) to all three observers, and an oral review of the answers given by each observer. Additional opportunities to practice observation and recording procedures were also provided to the secondary and third observers until an interobserver agreement of at least 80% was reached between the primary and secondary and the primary and third observer.

Definition and Measurement of Dependent Variables

Dependent measures were taken on students' on and off-task classroom behaviors, appropriate or disruptive classroom behaviors, daily quiz performance, student preferences and opinions of the different response modes used in this study, and teacher preferences and opinions of the different response modes used in this study.

Classroom Behaviors

The classroom behaviors recorded for the four target students were on-task/off-task and appropriate or disruptive classroom behavior. The occurrence of these behaviors was measured using a partial interval recording procedure for on-task or off-task behaviors and a whole interval recording procedure for appropriate and disruptive classroom behaviors. (Appendix D). A second year masters' student in special education served as the primary observer. The regular classroom teacher served as the secondary observer. An audio tape recorder was used to cue the observer(s) when to observe each student and
when to record data on the observation form. Recorded on the tape were the cues to the observer(s) when to observe ("observe Student 1") and then, five seconds later, when to record ("record Student 1"). Five seconds later, the next cue was "observe Student 2". This would occur systematically cueing the observer(s) to observe and record each student (1-4). After the cues for Student 4, the cycle would repeat itself starting with Student 1. This cycle of observation and recording continued until the end of the session. Headphones were used by each observer so that the students did not hear the recorded cues.

**On-task Behaviors**

On-task behaviors for this study is defined as when a student engaged in an activity related to the academic lesson. On-task was defined as one or more of the following behaviors: in-seat during work time, eyes directed toward work or teacher, sitting with appropriate posture while focusing on the teacher or activity related to the lesson and completing work assigned as part of the lesson being taught. The duration of each observation was 5 seconds, during which the student must have demonstrated on-task behavior for the entire 5 second interval. In order for the observer to score the interval as "on-task", the student must have been demonstrating on-task behaviors for the entire interval. Any occurrence of off-task behavior during that interval (such as looking out the window or writing when not directed to write) resulted in the interval being recorded as off-task for that interval. At the end of each observed interval, the observer was then cued to record the behavior on the rating form. The observer had 5 seconds to record the data before being cued to observe the next target student. An interval-by-interval comparison was conducted. The experimenter counted the number of intervals in which the on-task behavior occurred at the end of each lesson. The total number was then divided by the total number of intervals in which the student
was observed. The resulting quotient, multiplied by 100, gave the percentage of time each student was observed to be on-task during the lesson.

Off-task Behaviors

Off-task behavior is defined as when a student engaged in an activity other than those related to the academic lesson, but did not attempt to involve others in his/her behaviors. Off-task was defined as one or more of the following behaviors: out of seat during in-seat work time, eyes directed away from work or teacher, head rested on desk, or completing work not part of the lesson being taught. The duration of each observation interval will be 5 seconds, during which any occurrence of the behavior will be recorded as off-task for that interval. At the end of each observed interval, the observer will be cued to record the behavior on the rating form. The observer will have 5 seconds to record the data before being cued to observe the next target student. The observer will count the number of intervals in which the off-task behavior occurred at the end of each lesson. The total number will then be divided by the total number of intervals in which the student was observed. The resulting quotient, multiplied by 100, will give the percentage of time each student is off-task during the lesson.

Appropriate Classroom Behavior

Appropriate classroom behavior for this study is defined as engaging in behaviors related to current academic lesson. The same rating form used to record on-task/off-task behavior was used to record appropriate and disruptive behaviors of the target students (see Appendix D). The duration of each observation was 5 seconds, during which the student must have demonstrated appropriate classroom behavior for the entire 5 second interval. In order for the observer to score the interval as "appropriate", the student must have been demonstrating appropriate classroom behaviors for the entire interval. Any occurrence of disruptive behavior during that interval (such as talking out or making noises) resulted in the interval being recorded as "disruptive" for that interval. At the end
of each observed interval, the observer was then cued to record the behavior on the rating form. The observer had 5 seconds to record the data before being cued to observe the next target student. An interval-by-interval comparison was conducted. On-task/off-task and appropriate/disruptive behaviors were observed simultaneously. The experimenter counted the number of intervals in which the appropriate behavior occurred at the end of each lesson. The total number of appropriate behavior intervals was then divided by the total number of intervals in which the student was observed. The resulting quotient, multiplied by 100, gave the percentage of time each student demonstrated appropriate classroom behaviors during the lesson.

**Disruptive Classroom Behaviors**

Disruptive behavior for this study is defined as attempting to or engaging others in behaviors unrelated to the current academic lesson. Disruptive behavior were seen as one or more of the following: engaging in conversation with others during teacher directed instruction, provoking others (i.e. pounding desk, non-specific auditory responses voicing disapproval, tapping or wandering around the class.) The same rating form used to record on-task/off-task behavior was used to record appropriate/disruptive behaviors of the target students (Appendix D). Each student was observed for 5 second intervals during which any occurrence of disruptive behavior was recorded as disruptive for that interval. On-task/off-task and appropriate/disruptive behaviors were observed simultaneously. At the end of each observed interval, the observer was cued to record the behavior on the rating form. The observer had 5 seconds to record the data before being cued to observe the next target student. The experimenter counted the number of intervals in which the disruptive behavior occurred at the end of each lesson. The total number was then divided by the total number of intervals in which the student was observed. The resulting quotient, multiplied by 100, gave the percentage of time each student was disruptive during the lesson.
Daily Quiz Scores

A quiz was given at the end of each lesson consisting of 7 recall items (Appendix B). The questions were derived from the facts and concepts of the scripted lessons for that day. These questions were typed by the experimenter on the computer keyboard and printed out daily, one for each student. The quiz form given to the students consisted of the question with a blank space within each question in which the students wrote their answer to each question. Each student read their quiz silently, with the exception of Student 1, to whom the quiz was read by the third observer. An item was marked correct if it matched the answer on the answer key (see Appendix C). One point was given for each item answered correctly. Student responses were correct if they were recognizable by the experimenter as the correct answer even if any of the following spelling errors were made: reversal of two letter, an addition of a letter, the omission of a single letter or substitution of a single letter, as long as the spelling error did not produce another incorrect response (e.g. car for card). Words spelled phonetically were counted as correct.

Quiz feedback: The teacher provided a positive written statement on each student’s quiz next to the quiz score (e.g., scores of 7 resulted in "Excellent" or "Fantastic"; scores of 6 resulted in a positive statement such as "Good Job!" or "Great!"; scores of 5 resulted in positive written statements such as "I like the way you are trying!"; or "Keep working hard!"; scores of 4 or below resulted in positive statements such as "Keep trying", or "I like the way you tried to answer all of the questions!" This was held constant across both conditions.

Accuracy of Permanent Product Data

The experimenter used an answer key to grade each daily quiz (Appendix C). The number of correct responses to the 7 items by each student were recorded on a data sheet for each student in the class (Appendix E). A second observer also scored student

48
quizzes using an answer key. There was 100% agreement between observers on student quiz scores for each lesson.

**Interobserver Agreement Data**

For the classroom behavior dependent measures, a tape player was used to cue the primary and secondary observers when to observe each student and when to record each student. Each observer used a headphone plugged into the same tape player, (using a jack), that enabled the observers to simultaneously hear the taped cues, also ensuring that the students and teacher did not hear the taped cues. Interobserver agreement assessments were taken on the total intervals each student is observed. Interobserver agreement assessments were taken for at least 25% of the total lessons for each condition of the independent variable. IOA was calculated for each student using the following formula:

\[
\frac{\text{Agreements}}{\text{Agreements} + \text{Disagreements}} \times 100
\]

**Experimental Phases**

There were two conditions used throughout the study: single student response and the use of write-on response cards. The experimenter served as the teacher for each condition. A scripted lesson was used by the experimenter to teach each lesson throughout the study. (Appendix G). Each scripted lesson for each condition contained the same number of questions posed to the students. A third observer was supplied with a sequential checklist of the procedures the teacher follows during each lesson and during the administration of the daily quiz. Observations were recorded on a checklist by the third observer.
Procedural integrity was conducted using a checklist form measuring the occurrence of correctly followed procedures (Appendix I). Procedural reliability assessments were taken for at least 25% of the total lessons for each condition of the independent variable. IOA was calculated for procedural integrity using the following formula:

\[
\text{IOA} = \frac{\text{Procedural steps followed correctly (checks)}}{\text{Procedural steps followed incorrectly (no checks)}} \times 100 \\
+ \frac{\text{Procedural steps followed correctly (checks)}}{\text{Procedural steps followed correctly (checks)}}
\]

**Subject Matter and Curriculum Design**

Science was the subject matter for all instructional sessions. The information was designed to be used for daily whole-class instruction, calling for short, one-word answers from the students. Specific science units were developed on topics discussed by the experimenter and the teacher. The curriculum guidelines for the district the school is located in were used.

**Materials**

**Lecture Outlines**

A lecture outline was prepared by the experimenter for each session. Each lecture outline contained all of the science facts/concepts to be presented during the session. Questions for instruction and review were generated from the outline (Appendix G). Each lecture outline for each condition (single student response or write-on response cards) contained the same number of questions posed to the students. Only the manner in which the students answered changed according to which condition was being applied.

**Instructional Transparencies**

Transparencies were used by the experimenter to present information to the students.
**Overhead Projector**

An overhead projector was used to project instructional transparencies onto a screen located in the classroom.

**Write-on Response Cards**

Write-one response cards are 12" x 9" particle boards covered on one side with white laminate. Students wrote their responses on the response cards with dry erase markers in response to the questions posed by the teacher during instruction. Students were allowed time to draw on the response cards following the daily quiz.

**Dry Erase Markers**

Each student was supplied with a dry erase marker on response card days with which to write their responses on the write-on response cards.

**Facial Dry Tissues**

Tissues were used by the students to erase their responses on their individual response cards.

**Water Soluble Marking Pens**

Various colored fine-point water soluble overhead projector pens were used by the teacher to write on the instructional transparencies.

**Daily Quizzes**

A daily quiz was given at the end of the each lesson. Each quiz will consisted of 7 recall questions (Appendix B). Students read their quizzes silently, with the exception of Student 1, to whom his quiz was read to him by a third observer.

**Daily Quiz Answer Form**

Students responded to the questions on the daily quiz by writing their answers on the quiz answer form which consisted of the quiz question, each containing a blank in which the student wrote their response to the question (Appendix B).
Cover Sheet for Quizzes

A white sheet of 8 1/2" x 11" lined writing paper served as a cover sheet for students to use to cover their answers during the quiz.

Data Collection Sheets

Data collection sheets were used to record the on-task/off-task and appropriate/disruptive behaviors of the target students (Appendix D), and for the academic performance of each target student (Appendix E). Forms were also used for procedural integrity (Appendix I).

Data Summary Sheet

A data summary sheet was used to summarize the quiz score, and the on-task and disruptive classroom behaviors (Appendix E.)

Procedural Integrity Checklist

A procedural integrity checklist was used to ensure proper procedures were followed during the experimental conditions (see Appendix I).

Student Consumer Satisfaction Questionnaire

Following the completion of the study, 25 of the 28 participants present were orally asked questions about the use of single student responding and write-on response cards (Appendix G).

Teacher Consumer Satisfaction Questionnaire

Following the completion of the study, both classroom teachers were asked to fill out a questionnaire regarding the use of single student responding and use of write-on response cards (Appendix H).

Experimental Design

An ABAB reversal design will be used in this study. The ABAB reversal design is characterized by repeated measurement of behavior in a given setting during three consecutive phases of an experiment: a baseline phase in which the independent variable
is absent, an intervention phase, a return to prior baseline conditions followed by the reintroduction of the intervention condition (Cooper, Heward, & Heron, 1987). There were two conditions used in this study; the condition of single student responding, in which a random list of student names corresponding to each question asked will be used to call on a student to respond, and the condition of write-on response cards.

**General Procedures**

The teacher prepared for each session by setting up the overhead projector and screen, arranging the transparencies, and the lecture outline. Before each write-on response card session, a dry erase maker and facial tissue was placed on each student's desk.

Each instructional session lasted approximately 30 minutes (20 minutes of facts/concepts, 5 minute experiment, and 5-8 minute quiz). The observer(s) recorded behavioral data during the twenty-minute fact/concept presentation portion of the lesson. Student data was collected and recorded during the remainder of the lesson, however, this data was not calculated into the percentage of intervals that each student demonstrated on-task or disruptive behaviors because response cards or single student responding was not used during that time period. The teacher presented science information to the students and questioned them after each fact/concept had been presented. A total of 7 facts/concepts were presented during each lesson, each being repeated as a review before participating in the daily science experiment coinciding with those facts/concepts. The teacher used verbal communication, overhead projector materials, and science demonstrations to instruct the students. The teacher had the facts and concepts to be covered for each lesson printed by hand on overhead projector transparencies. Progressive disclosure and corresponding verbal communication were presented by the teacher to present each fact/concept. A daily quiz followed each experiment. Questions were taken from those facts/concepts presented during the lesson. Quizzes were scored that evening and returned to students prior to beginning the next day’s lesson. Feedback
statements regarding the academic performance of students were written on each student quiz next to the quiz score (e.g., scores of 7 resulted in “Excellent!” or “Fantastic!”; scores of 6 resulted in a positive statement such as “Good Job!” or “Great!”; scores of 5 resulted in positive written statements such as “I like the way you are trying!”; scores of 4 or below resulted in positive statements such as “Keep trying!”). No data was collected on feedback statements regarding student academic performance. Quiz feedback statements were held constant across conditions.

There were no unplanned interruptions during this study.

**Single Student Responding**

Prior to the first experimental session, the experimenter trained the students on the correct procedures for responding to the teacher’s questions. Students were instructed to answer the question to the best of their ability when called upon to answer the question by the teacher.

The experimenter used a list of all of the students’ names to determine who was called upon to answer each question. A list of random numbers was used to create five different lists of the students’ names to be used on alternating days. This was done to eliminate the possibility of teacher bias in calling on certain students more than others. The random lists were made by assigning a number to each student’s name and then placing one corresponding number for each student on a separate slip of paper. The slips of paper were then placed in a bag and drawn out one at a time. Each number that was drawn out was matched with the name it represented to determine the order of the names on the list until all the numbers were drawn. This procedure was repeated five times in order to produce the five random lists used during the study. The experimenter called upon the first student on the list to answer the first question, the second person to answer the second question, and so on. The experimenter looked at the random list for the name of the student while counting the 3-second wait time. Students were not aware when they
would be called upon to answer a question. During single student response sessions, if the student called upon responded correctly, the teacher said the student's name followed by a positive comment (e.g. "Yes, Brian, that is correct! Good job!") If the student who was called upon answered the question incorrectly, the teacher said "No, the answer is......."

There was a practice session using science curriculum not covered in the daily lessons in order to ensure the students knew the appropriate behaviors for the single student responding conditions. Observers also participated in this training session in order to practice the observation and recording procedures.

On the first day of the single student response condition, the experimenter introduced the students to the science content to be covered and reviewed the student responding procedures. During the instructional sessions, the experimenter waited for 3 seconds after asking each question and then called upon one student to answer the question. The experimenter counted to 3 seconds by covertly saying "One thousand one, one thousand two, one thousand three."

Write-on Response Cards

The experimenter held a write-on response card practice session prior to the first session of the response card phase. Students were instructed to respond to the questions asked by the experimenter by printing one or two word answers on their individual write-on response cards. The observers also participated in this session in order to practice the observation and recording procedures.

After posing each question, the experimenter said "Write.." to cue the students to begin writing their answer. After a 3 - 5 second wait time, (determined by the experimenter counting to herself), the experimenter said "Class..." The students then held their response cards above their heads so that the teacher could see all of the students' responses. During response card sessions, if most or all of the students held up the correct answer, the teacher said "Great class! That is correct!" If some students had written the
correct response, but many students display an incorrect response, the teacher responded by saying "I see some of you have the correct answer of _______." If most of the class displays an incorrect answer, the teacher said "Class, the correct answer is _______" and repeated the question at a later time.

The experimenter then said "Put down your cards and erase your answers." The students then erased their answers and prepared for the next question.

Students were given the opportunity to draw or write appropriately on the write-on response cards upon completion of the quiz (for a period of 3 - 5 minutes) to reduce the novelty of using the response boards, decreasing the likelihood of misuse of the write-on response cards during the lesson.

**Procedural Integrity**

Procedural integrity was conducted using a checklist form measuring the occurrence of correctly followed procedures (Appendix I). The procedural integrity observer put a check mark in a space provided next to the procedure if it was followed, put a minus in the space if the procedure was not followed, or write N/A in the blank if the procedure was not applicable during that specific condition. Procedural integrity was collected by a third observer for at least 25% of the sessions using the procedural integrity recording sheet (Appendix I).
CHAPTER 4

RESULTS

This chapter presents results of the study. Procedural integrity, interobserver reliability accuracy measure, and data are presented. Individual student data are presented for on-task behavior, disruptive classroom behavior, daily quiz scores, and for student and teacher consumer satisfaction.

Procedural Integrity

A procedural integrity checklist was completed by a third observer for at least 25% of the sessions during each phase of the intervention. Procedural integrity was conducted in 7 of the 26 sessions of the study using a procedural checklist (see Appendix I). Procedural integrity was completed in 3 Single Student Responding sessions (SSR) and 4 Write-on Response Card sessions. Procedural integrity was calculated at 100% across all seven of the 26 sessions data was collected.

Interobserver Reliability

On-Task Behaviors

Table 1 displays the average percentage of interobserver agreement for on-task behaviors based on an interval by interval comparison for each student by experimental phase. Each day interobserver agreement checks were conducted, the total amount of intervals observed for each student was used to calculate the percent agreement for that particular student. Interobserver agreement was conducted in 13 of the 26 sessions, or 50% of the sessions. All interobserver checks for on-task behaviors were completed simultaneously with disruptive behavior interobserver agreement checks. The mean
The percentage of interobserver reliability ranged from a low on Student 1 of 70% agreement during Single Student Responding-1 (SSR) to a high of 100% with Student 3 during SSR-2 and WORC-2.

Table 1
Percentage of Interobserver Agreement for On-Task Behaviors by Experimental Condition.

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<td>80-100</td>
<td>57-100</td>
<td>77-100</td>
</tr>
</tbody>
</table>

Note. Numbers in parentheses indicate the number of lessons Interobserver agreement measures were taken out of the total number of sessions for that condition.
Table 2 displays the average percentage of interobserver agreement on number of intervals disruptive classroom behaviors were observed for each student by experimental phase. Each day interobserver agreement checks were conducted, the total amount of intervals observed for each student was used to calculate the percent agreement for that particular student. All students were checked by the second observer 13 of 26 sessions, or 50%, of the total sessions. During SSR-1, four of the eight sessions had a second observer. There were four sessions during SSR-2, interobserver agreement checks were completed during two sessions. There were six interobserver agreement checks across the twelve SSR sessions. During the initial Write-on Response Card Phase (Write-on Response Card-1) there were eight sessions, interobserver checks were completed during four of the sessions. Write-on Response Card-2 consisted of six sessions during three of these sessions interobserver agreement checks were completed. There were a total of 14 sessions during Write-on Response Card conditions and a total of seven interobserver agreement checks.

**On-Task Behaviors**

This section presents the percentage of intervals each student was observed to be on-task. The average percentage score for both single student responding and write-on response cards conditions are presented. Finally, the average combined SSR and WORC conditions percentage scores for each student and the group as a whole is also provided.
Table 2

Percentage of Interobserver Agreement for Disruptive Classroom Behaviors by Experimental Condition.

<table>
<thead>
<tr>
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</tr>
<tr>
<td>Mean</td>
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<td>90-100</td>
<td>80-100</td>
<td>70-100</td>
<td>77-100</td>
</tr>
</tbody>
</table>

Note. Numbers in parentheses indicate the number of lessons Interobserver agreement measures were taken out of the total number of sessions for that condition.
Figure 2 shows Student 1's average percentage of time engaged in on-task behavior for both experimental conditions of the independent variable. Student 1 was present for 10 lessons out of 12 lessons taught during SSR conditions and 11 out of 14 lessons taught during write-on response cards conditions.

**SSR conditions.** In the first condition of the study in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 1's mean percentage of on-task behaviors was 46% of the observed intervals, with a range of 13% to 70%, during instruction. During the SSR-2 condition, Student 1's mean percentage of on-task behaviors was 45% of the observed intervals, with a range of 43% to 47% during instruction. Student 1's mean percentage of on-task was 46% of the observed intervals during combined SSR conditions with a range of 13% to 70%. Student 1 was slightly more on-task during the SSR-1 condition as compared to the second. There was a change in variability of on-task behavior across the SSR conditions.

**Write-on response cards conditions.** During the initial write-on response cards condition, Student 1's mean percentage of on-task behaviors was 70% of the observed intervals, with a range of 57% to 87%, during instruction. During the write-on response cards-2 condition, Student 1's mean percentage of on-task behaviors was 69% of the observed intervals, with a range of 63% to 80% during instruction. During the combined write-on response cards condition, Student 1's mean percentage of on-task behavior was 70% of the observed intervals with a range of 57% to 87%. Student 1 was slightly more on-task during the first write-on response cards condition as compared to the second.
Figure 2. Percentage intervals of on-task and disruptive classroom behavior for Student 1 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
Student 2

Figure 3 shows Student 2's average percentage of time engaged in on-task behavior for both experimental conditions of the independent variable. Student 2 was present for 12 out of 12 lessons taught during single student responding conditions and 14 out of 14 lessons taught during write-on response cards conditions.

SSR conditions. In the first condition of the study in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 2's mean percentage of on-task behaviors was 35% of the observed intervals, with a range of 7% to 73%, during instruction. During the SSR-2 condition, Student 2's mean percentage of on-task behaviors was 28% of the observed intervals, with a range of 17% to 47% during instruction. Student 2's mean percentage of on-task was 32% of the observed intervals during combined SSR conditions with a range of 7% to 73%. Student 2 demonstrated a higher percentage of on-task behavior during the first SSR condition as compared to the second. There was a change in variability of on-task behavior across the SSR conditions.

Write-on response cards conditions. During the initial write-on response cards condition, Student 2's mean percentage of on-task behaviors was 55% of the observed intervals, with a range of 47% to 80%, during instruction. During the write-on response cards-2 condition, Student 2's mean percentage of on-task behaviors was 67% of the observed intervals, with a range of 53% to 87%, during instruction. During the combined write-on response cards condition, Student 2's mean percentage of on-task behavior was 61% of the observed intervals with a range of 47% to 87%. Student 2 was more on-task during the WORC-2 as compared to WORC-1.
Figure 3. Percentage intervals of on-task and disruptive classroom behaviors for Student 2 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
Student 3

Figure 4 shows Student 3's average percentage of time engaged in on-task behavior for both experimental conditions of the independent variable. Student 3 was present for 12 lessons out of 12 lessons taught during SSR conditions and 14 out of 14 lessons taught during write-on response cards conditions.

SSR conditions. In the first condition of the study in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 3's mean percentage of on-task behaviors was 44% of the observed intervals, with a range of 23% to 77%, during instruction. During the SSR-2 condition, Student 3's mean percentage of on-task behaviors was 55% of the observed intervals, with a range of 50% to 67% during instruction. Student 3's mean percentage of on-task was 50% of the observed intervals during combined SSR conditions with a range of 23% to 77%. Student 3 was more on-task during the second SSR condition as compared to the first.

Write-on response cards conditions. During the initial write-on response cards condition, Student 3's mean percentage of on-task behaviors was 61% of the observed intervals, with a range of 47% to 73%, during instruction. During the write-on response cards-2 condition, Student 3's mean percentage of on-task behaviors was 66% of the observed intervals, with a range of 60% to 73%, during instruction. During the combined write-on response cards condition, Student 3's mean percentage of on-task behavior was 64% of the observed intervals with a range of 47% to 73%. Student 3 was more on-task during the second write-on response cards condition as compared to the first.
Figure 4. Percentage intervals of on-task and disruptive classroom behaviors for Student 3 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
Student 4

Figure 5 shows Student 4's average percentage of time engaged in on-task behavior for both experimental conditions of the independent variable. Student 4 was present for 11 lessons out of 12 lessons taught during SSR conditions and 14 out of 14 lessons taught during write-on response cards conditions.

SSR conditions. In the first condition of the study in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 4's mean percentage of on-task behaviors was 45% of the observed intervals, with a range of 17% to 77%, during instruction. During the SSR-2 condition, Student 4's mean percentage of on-task behaviors was 44% of the observed intervals, with a range of 40% to 50% during instruction. Student 4's mean percentage of on-task was 45% of the observed intervals during combined SSR conditions with a range of 17% to 77%. Student 4 demonstrated a slightly higher percentage of on-task behavior during the first SSR condition as compared to the second.

Write-on response cards conditions. During the initial write-on response cards condition, Student 4's mean percentage of on-task behaviors was 68% of the observed intervals, with a range of 53% to 77%, during instruction. During the write-on response cards-2 condition, Student 4's mean percentage of on-task behaviors was 71% of the observed intervals, with a range of 60% to 80%, during instruction. During the combined write-on response cards condition, Student 4's mean percentage of on-task behavior was 70% of the observed intervals with a range of 53% to 80%. Student 4 demonstrated a slightly higher percentage of on-task behavior during the second write-on response cards condition as compared to the first write-on response cards condition.
Figure 5. Percentage intervals of on-task and disruptive classroom behaviors for Student 4 during both Single Student Responding (SSR) and Write-on Response Card conditions.
Group

Table 3 shows the average percentage of observed intervals students demonstrated on-task behaviors by conditions. The average combined single student responding scores and the average combined write-on response cards scores for each student is also provided.

SSR conditions. During the SSR-1 condition of the study, in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, the group's mean percentage of on-task behaviors was 43% of the observed intervals with a range of 7% to 77%. During the SSR-2 condition, the group engaged in on-task behaviors a mean percentage of 43% of the observed intervals with a range of 17% to 67%. During the combined SSR conditions, the group's mean percentage of on-task behavior was 43% of the observed intervals with a range of 7% to 77%. The group demonstrated the same percentage of on-task behavior during both SSR conditions.

Write-on response cards conditions. During the write-on response cards-1 condition, the group's mean percentage of on-task behaviors was 64% of the observed intervals with a range of 47% to 87%. During the write-on response cards-2 condition, the group engaged in on-task behaviors a mean percentage of 68% of the observed intervals with a range of 53% to 87%. During the combined write-on response cards conditions, the group's mean percentage of on-task behavior was 66% of the observed intervals with a range of 47% to 87%. The group demonstrated a slightly higher percentage of on-task behavior during the second write-on response cards condition as compared to the first write-on response cards condition.
Table 3

Mean Percentage of Time Students Demonstrated On-Task Behavior by Condition

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<tr>
<th>Student</th>
<th>SSR-1 (8)</th>
<th>WORC-1 (8)</th>
<th>SSR-2 (4)</th>
<th>WORC-2 (6)</th>
<th>Combined SSR</th>
<th>Combined WORC</th>
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</thead>
<tbody>
<tr>
<td>1</td>
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</table>

Note. Numbers in parentheses indicate the number of lessons Interobserver agreement measures were taken out of the total number of sessions for that condition.

Disruptive Classroom Behavior

This section presents the percentage of intervals each of the four targeted students were observed demonstrating disruptive classroom behavior. The average percentage score for both single student responding and write-on response cards conditions are presented. Finally, the average combined single student responding and write-on response cards conditions percentage scores for each student and the group as a whole is also provided.
Student 1

Figure 2 shows Student 1’s average percentage of time engaged in disruptive classroom behavior for both experimental conditions of the independent variable. Student 1 was present for 10 lessons out of 12 lessons taught during single student responding conditions and 11 out of 14 lessons taught during write-on response cards conditions.

**SSR conditions.** In the first condition of the study in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students’ names in the class, Student 1’s mean percentage of disruptive classroom behaviors was 12% of the observed intervals, with a range of 3% to 20%, during instruction. During the SSR-2 condition, Student 1’s mean percentage of disruptive classroom behavior was 20% of the observed intervals, with a range of 17% to 23% during instruction. Student 1’s mean percentage of disruptive classroom behavior was 16% of the observed intervals during combined SSR conditions with a range of 3% to 23%. Student 1 demonstrated a higher percentage of disruptive classroom behaviors during the first SSR condition as compared to the second. There was change in the variability of disruptive classroom behavior across the SSR phases with a range of 3% to 20% in the first SSR condition as compared to a range of 17% to 23% in the second SSR condition.

**Write-on response cards conditions.** During the initial write-on response cards condition, Student 1 engaged in disruptive classroom behaviors a mean percentage of 17% of the observed intervals, with a range of 3% to 30% during instruction. During the write-on response cards-2 condition, Student 1 engaged in disruptive classroom behaviors a mean percentage of 19% of the observed intervals, with a range of 3% to 43% during instruction. During combined write-on response card conditions, Student 1’s average disruptive classroom behavior was 18% of the observed intervals with a range of 3% to
43%. Student 1's disruptive classroom behavior showed a slight decrease from the first write-on response cards condition to the second.

**Student 2**

Figure 3 shows Student 2's average percentage of time engaged in disruptive classroom behavior for both experimental conditions of the independent variable. Student 2 was present for 12 lessons out of 12 lessons taught during single student responding conditions and 14 out of 14 lessons taught during write-on response cards conditions.

**SSR conditions.** In the first condition of the study in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 2's mean percentage of disruptive classroom behavior was 13% of the observed intervals, with a range of 3% to 27%, during instruction. During the SSR-2 condition, Student 2's mean percentage of disruptive classroom behavior was 14% of the observed intervals, with a range of 0% to 23% during instruction. Student 2's mean percentage of disruptive classroom behavior was 14% of the observed intervals during combined SSR conditions with a range of 0% to 27%. Student 2 demonstrated a slightly higher percentage of disruptive classroom behaviors during the second SSR condition as compared to the first. There was some change in the variability of disruptive classroom behavior across the SSR phases with a range of 3% to 27% in the first SSR condition as compared to a range of 0% to 23% in the second SSR condition.

**Write-on response cards conditions.** During the initial write-on response cards condition, Student 2 engaged in disruptive classroom behaviors a mean percentage of 12% of the observed intervals, with a range of 3% to 37% during instruction. During the write-on response cards-2 condition, Student 2 engaged in disruptive classroom behaviors a mean percentage of 6% of the observed intervals, with a range of 0% to 10% during
instruction. During combined write-on response card conditions, Student 2’s average disruptive classroom behavior was 18% of the observed intervals with a range of 3% to 43%. Student 2’s disruptive classroom behavior showed an increase from the first write-on response cards condition to the second.

**Student 3**

Figure 4 shows Student 3’s average percentage of time engaged in disruptive classroom behavior for both experimental conditions of the independent variable. Student 3 was present for 12 out of 12 lessons taught during single student responding conditions and 14 out of 14 lessons taught during write-on response cards conditions.

**SSR conditions.** In the first condition of the study in which students were individually called upon to answer questions by the teacher from a preselected random containing all of the students’ names in the class, Student 3’s mean percentage of disruptive classroom behaviors was 19% of the observed intervals, with a range of 7% to 40%, during instruction. During the SSR-2 condition, Student 3’s mean percentage of disruptive classroom behavior was 10% of the observed intervals, with a range of 0% to 10% during instruction. Student 3’s mean percentage of disruptive classroom behavior was 15% of the observed intervals during combined SSR conditions with a range of 0% to 40%. Student 3 demonstrated a higher percentage of disruptive classroom behaviors during the first SSR condition as compared to the second. There was change in the variability of disruptive classroom behavior across the SSR phases with a range of 7% to 40% in the first SSR condition as compared to a range of 0% to 10% in the second SSR condition.

**Write-on response cards conditions.** During the initial write-on response cards condition, Student 3 engaged in disruptive classroom behaviors a mean percentage of 14% of the observed intervals, with a range of 0% to 27% during instruction. During the write-on response cards-2 condition, Student 3 engaged in disruptive classroom behaviors
a mean percentage of 19% of the observed intervals, with a range of 13% to 23% during instruction. During combined write-on response card conditions, Student 3's average disruptive classroom behavior was 17% of the observed intervals with a range of 0% to 27%. Student 3's disruptive classroom behavior showed an increase from the first write-on response cards condition to the second.

**Student 4**

Figure 5 shows Student 4's average percentage of time engaged in disruptive classroom behavior for both experimental conditions of the independent variable. Student 4 was present for 11 out of 12 lessons taught during single student responding conditions and 14 out of 14 lessons taught during write-on response cards conditions.

**SSR conditions.** In the first condition of the study in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 4's mean percentage of disruptive classroom behaviors was 19% of the observed intervals, with a range of 7% to 30%, during instruction. During the SSR-2 condition, Student 4's mean percentage of disruptive classroom behavior was 27% of the observed intervals, with a range of 10% to 37% during instruction. Student 4's mean percentage of disruptive classroom behavior was 23% of the observed intervals during combined SSR conditions with a range of 7% to 37%. Student 4 demonstrated a higher percentage of disruptive classroom behaviors during the second SSR condition as compared to the first. There was change in the variability of disruptive classroom behavior across the SSR phases with a range of 7% to 30% in the first SSR condition as compared to a range of 10% to 37% in the second SSR condition.

**Write-on response cards conditions.** During the initial write-on response cards condition, Student 4 engaged in disruptive classroom behaviors a mean percentage of 19% of the observed intervals, with a range of 10% to 33% during instruction. During
the write-on response cards-2 condition, Student 4 engaged in disruptive classroom behaviors a mean percentage of 16% of the observed intervals, with a range of 7% to 23% during instruction. During combined write-on response card conditions, Student 4's average disruptive classroom behavior was 18% of the observed intervals with a range of 7% to 33%. Student 4's disruptive classroom behavior showed a slight decrease from the second write-on response cards condition as compared to the first.

**Group**

Table 4 shows the average percentage of time students demonstrated disruptive classroom behavior by condition. The average combined single student responding scores and the average combined write-on response cards scores for each student is also provided.

**SSR conditions.** During the first SSR condition, in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, the group's mean percentage of disruptive classroom behaviors was 16% of the observed intervals with a range of 3% to 40%. During the SSR-2 condition, the group's mean percentage of disruptive classroom behaviors was 18% of the observed intervals with a range of 0% to 37%. The mean percentage for combined SSR conditions was 17% with a range of 0% to 40%. The group demonstrated a slightly higher percentage of disruptive classroom behaviors during the second SSR condition as compared to the first SSR condition.
Table 4

Mean Percentage of Time Students Demonstrated Disruptive Classroom Behavior By Condition.

<table>
<thead>
<tr>
<th>Student</th>
<th>SSR-1 (8)</th>
<th>WORC-1 (8)</th>
<th>SSR-2 (4)</th>
<th>WORC-2 (6)</th>
<th>Combined SSR</th>
<th>Combined WORC</th>
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<tr>
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<td>20</td>
<td>19</td>
<td>16</td>
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<td>3-30</td>
<td>17-23</td>
<td>3-43</td>
<td>13-23</td>
<td>3-43</td>
</tr>
<tr>
<td>2</td>
<td>13</td>
<td>12</td>
<td>14</td>
<td>6</td>
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<td>0-10</td>
<td>0-27</td>
<td>0-37</td>
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<td>15</td>
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<td>0-10</td>
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<td>10-37</td>
<td>7-23</td>
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<td>7-33</td>
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<tr>
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<td>0-37</td>
<td>0-43</td>
<td>0-40</td>
<td>7-33</td>
</tr>
</tbody>
</table>

Note. Numbers in parentheses indicate the number of lessons Interobserver agreement measures were taken out of the total number of sessions for that condition.

Write-on response cards condition: During the initial write-on response card condition, the group engaged in disruptive classroom behaviors a mean percentage of 16% of the observed intervals with a range of 0% to 37%. During write-on response cards-2 condition, the group engaged in disruptive classroom behaviors a mean percentage of 15% of the observed intervals with a range of 0% to 43%. During the combined write-on response card conditions, the group's mean percentage of disruptive classroom behaviors was 16% of the observed intervals with a range of 7% to 33%. The group demonstrated a slightly higher percentage of disruptive classroom behavior during the first write-on response cards condition as compared to the second.
Accuracy Measures

Daily Quiz Scores

All targeted students' quizzes were checked by a third observer for each quiz score obtained. No disagreements occurred in the 26 quizzes graded. The total interobserver agreement on daily quiz scores for each student was 100%.

Daily Quiz Scores

This section presents the quiz scores of each target student and for all of the students in the class participating in academic performance data collection. The average score for both single student responding and write-on response card conditions are presented. Finally, the number of lessons each student was present during each condition, the average combined single student responding scores, and the average combined write-on response card scores for each student and group are provided.

Student 1

Figure 6 shows Student 1's performance on daily 7-item quizzes for both experimental conditions of this study. Student 1 was present for 10 out of 12 lessons during single student responding conditions and 11 out of 14 lessons during write-on response card conditions.

SSR conditions. During the SSR-1 condition in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 1 answered an average of 4.4 items correctly out of a possible 7 points, with a range of 1 to 7 correct items. During the SSR-2 condition, Student 1's average quiz score was 3.5 with a range of 2 to 5. Student 1's quiz score performance showed a decrease from the first SSR phase to the second. The range of scores varied slightly from the first SSR condition to the second SSR condition. Student 1 was absent for 2 of the 4 SSR-2 sessions. The mean score for combined SSR sessions for Student 1 was 4.2 with a range of 1 to 7.
Figure 6. Number of correct quiz questions for Student 1 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
**Write-on Response Card conditions.** During the Write-on Response Card-1 condition, Student 1 earned an average of 3.4 out of a possible 7 points, with a range of 1 to 5 items correct. During the Write-on Response Cards-2 condition, Student 1's average quiz score was 2.7 with a range of 1 to 5. Student 1's mean quiz score for the combined write-on response card conditions was 3.0 correctly answered items with a range of 1 to 5. Student 1's quiz score performance showed a decrease from the first write-on response card condition to the second write-on response card condition. Student 1 was absent from 3 of the 8 sessions conducted during the Write-on Response Card-1 condition.

**Student 2**

Figure 7 shows Student 2's performance on daily 7-item quizzes for both experimental conditions of this study. Student 2 was present for 12 out of 12 lessons during single student responding conditions and 14 out of 14 lessons during write-on response cards conditions.

**SSR conditions.** During the SSR-1 condition in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 2 answered an average of 5.4 items correctly out of a possible 7 points, with a range of 3 to 7 correct items. During the SSR-2 condition, Student 2's average quiz score was 5.5 with a range of 5 to 7. Student 2's quiz score performance increased slightly from the first SSR condition to the second. The range of scores increased slightly from SSR-1 to SSR-2. The mean score for combined SSR sessions for Student 2 was 5.4 with a range of 3 to 7.

**Write-on Response Card conditions.** During the Write-on Response Card-1 condition, Student 2 earned an average of 5.5 out of a possible 7 points, with a range of 3 to 7 items correct. During the Write-on Response Card-2 condition, Student 2's average quiz score was 3.8 with a range of 2 to 7. Student 2's mean quiz score for the combined write-on response card conditions was 4.8 correctly answered items with a range of 2 to
Figure 7. Number of correct quiz questions for Student 2 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
7. Student 2's quiz score performance decreased during the second write-on response card condition as compared to the first write-on response card condition.

Student 3

Figure 8 shows Student 3's performance on daily 7-item quizzes for both experimental conditions of this study. Student 3 was present for 12 out of 12 lessons during single student responding conditions and 14 out of 14 lessons during write-on response cards conditions.

SSR conditions. During the SSR-1 condition in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 3 answered an average of 2.5 items correctly out of a possible 7 points, with a range of 0 to 6 correct items. During the SSR-2 condition, Student 3's average quiz score was 3.0 with a range of 0 to 5. Student 3's mean quiz score for the combined SSR conditions was 2.7 correctly answered items with a range of 0 to 6. Student 3's quiz score performance increased slightly from the first SSR condition to the second. The range of scores varied only slightly as well from first SSR condition to the second. The mean score for combined SSR sessions for Student 3 was 2.7 with a range of 0 to 6.

Write-on Response Card conditions. During the Write-on Response Card-1 condition, Student 3 earned an average of 4.3 out of a possible 7 points, with a range of 1 to 7 items correct. During the Write-on Response Cards-2 condition, Student 3's average quiz score was 4.3 with a range of 0 to 7 items correct. Student 3's mean quiz score for the combined write-on response cards conditions was 4.3 correctly answered items with a range of 0 to 7. Student 3's average quiz score performance remained the same for both write-on response cards conditions.
Figure 8. Number of correct quiz questions for Student 3 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
Student 4

Figure 9 shows Student 4's performance on daily 7-item quizzes for both experimental conditions of this study. Student 4 was present for 11 out of 12 lessons during single student responding conditions and 14 out of 14 lessons during write-on response card conditions.

**SSR conditions.** During the SSR-1 condition in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 4 answered an average of 6.6 items correctly out of a possible 7 points, with a range of 5 to 7 correct items. During the SSR-2 condition, Student 4's average quiz score was 6.0 with a range of 4 to 7. Student 4's mean quiz score for the combined SSR conditions was 6.5 correctly answered items with a range of 4 to 7. Student 4's quiz score performance showed a decrease from the first SSR condition to the second. The range of scores earned varied only slightly.

**Write-on Response Card conditions.** During the Write-on Response Card-1 condition, Student 4 earned an average of 6.3 out of a possible 7 points, with a range of 6 to 7 items correct. During the Write-on Response Card-2 condition, Student 4's average quiz score was 6.0 with a range of 2 to 7. Student 4's mean quiz score for the combined write-on response cards condition was 6.1 correctly answered items with a range of 2 to 7. Student 4's quiz score performance decreased from the first write-on response card condition as compared to the second.

Student 5

Figure 10 shows Student 5's performance on daily 7-item quizzes for both experimental conditions of this study. Student 5 was present for 11 out of 12 lessons during single student responding conditions and 14 out of 14 lessons during write-on response card conditions.
Figure 9. Number of correct quiz questions for Student 4 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
Figure 10. Number of correct quiz questions for Student 5 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
SSR conditions. During the SSR-1 condition in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 5 answered an average of 3.3 items correctly out of a possible 7 points, with a range of 2 to 7 correct items. During the SSR-2 condition, Student 5's average quiz score was 3.0 with a range of 2 to 4. The mean score for combined SSR conditions was 3.2 with a range of 2 to 7. Student 5's quiz score performance showed a slight decrease from the first SSR condition to the second. The range of scores varied from the first SSR condition to the second SSR condition. Student 5 was absent for 1 of the first eight SSR sessions and was present for all 4 SSR-2 sessions.

Write-on Response Card conditions. During the Write-on Response Card-1 condition, Student 5 earned an average of 4.4 out of a possible 7 points, with a range of 2 to 7 items correct. During the Write-on Response Cards-2 condition, Student 5's average quiz score was 4.5 with a range of 1 to 7. Student 5's mean quiz score for the combined write-on response card conditions was 4.4 correctly answered items with a range of 1 to 7. Student 5's quiz score performance showed a slight decrease from the first write-on response card condition to the second write-on response card condition. The range of scores varied only slightly. Student 5 was present for all of the 8 sessions conducted during the Write-on Response Card-1 condition, and all of the 6 sessions conducted during the Write-on Response Card-2 condition.

Student 6

Figure 11 shows Student 6's performance on daily 7-item quizzes for both experimental conditions of this study. Student 6 was present for 11 out of 12 lessons during SSR conditions and 14 out of 14 lessons during write-on response card conditions.
Figure 11. Number of correct quiz questions for Student 6 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
SSR conditions. During the SSR-1 condition in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 6 answered an average of 5.4 items correctly out of a possible 7 points, with a range of 3 to 7 correct items. During the SSR-2 condition, Student 6's average quiz score was 4.3 with a range of 3 to 6. Student 6's quiz score performance showed a decrease from the first SSR condition to the second. The range of scores varied slightly from the first SSR condition to the second SSR condition. Student 6 was absent for 1 of the 8 SSR-1 sessions. The mean score for combined SSR sessions for Student 6 was 5.0 with a range of 3 to 7.

Write-on Response Card conditions. During the Write-on Response Card-1 condition, Student 6 earned an average of 5.0 out of a possible 7 points, with a range of 2 to 7 items correct. During the Write-on Response Cards-2 condition, Student 6's average quiz score was 6.3 with a range of 5 to 7. Student 6's mean quiz score for the combined write-on response card conditions was 5.6 correctly answered items with a range of 2 to 7. Student 6's quiz score performance showed an increase from the first write-on response card condition to the second write-on response card condition. The range of scores varied only slightly.

Student 7

Figure 12 shows Student 1's performance on daily 7-item quizzes for both experimental conditions of this study. Student 7 was present for 10 out of 12 lessons during SSR conditions and 11 out of 14 lessons during write-on response card conditions.

SSR conditions. During the SSR-1 condition in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 7 answered an average of 6.2 items correctly out of a possible 7 points, with a range of 3 to 7 correct items. During the SSR-2 condition, Student 1's average quiz score was 6.0 with a range of 6. Student 7's quiz
Figure 12. Number of correct quiz questions for Student 7 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
score performance showed a slight decrease from the first SSR condition to the second. The range of scores varied from the first SSR condition to the second SSR condition. Student 7 was absent for 2 of the 8 SSR-1 sessions. The mean score for combined SSR sessions for Student 1 was 6.1 with a range of 3 to 7.

**Write-on Response Card conditions.** During the Write-on Response Card-1 condition, Student 7 earned an average of 6.5 out of a possible 7 points, with a range of 5 to 7 items correct. During the Write-on Response Cards-2 condition, Student 7's average quiz score was 7.0 with a range of 7. Student 7's mean quiz score for the combined write-on response card conditions was 6.6 correctly answered items with a range of 5 to 7. Student 7's quiz score performance showed an increase from the first write-on response card condition to the second write-on response card condition. The range of scores changed from 5 to 7 in WORC-1 to scoring 7 correct answers in all sessions attended in WORC-2. Student 7 was absent from 3 of the 6 sessions conducted during the Write-on Response Card-2 condition.

**Student 8**

Figure 13 shows Student 8's performance on daily 7-item quizzes for both experimental conditions of this study. Student 8 was present for 9 out of 12 lessons during single student responding conditions and 11 out of 14 lessons during write-on response card conditions.

**SSR conditions.** During the SSR-1 condition in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 8 answered an average of 6.6 items correctly out of a possible 7 points, with a range of 4 to 7 correct items. During the SSR-2 condition, Student 8's average quiz score was 6.0 with a range of 5 to 7. Student 8's quiz score performance showed a decrease from the first SSR condition to the second.
Figure 13. Number of correct quiz questions for Student 8 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
Student 8 was absent for 1 of the 8 SSR-1 sessions and 2 of the 4 SSR-2 sessions. The mean score for combined SSR sessions for Student 8 was 6.4 with a range of 4 to 7.

**Write-on Response Card conditions.** During the Write-on Response Card-1 condition, Student 8 earned an average of 6.9 out of a possible 7 points, with a range of 6 to 7 items correct. During the Write-on Response Cards-2 condition, Student 8's average quiz score was 7.0 with a range of 7. Student 8's mean quiz score for the combined write-on response card conditions was 6.9 correctly answered items with a range of 6 to 7. Student 8's quiz score performance showed a slight increase from the first write-on response card condition to the second write-on response card condition. The range of scores changed only slightly. Student 8 was absent from 1 of the 8 sessions conducted during the Write-on Response Card-1 condition and 2 of 6 sessions conducted during the Write-on Response Card-2 condition.

**Student 9**

Figure 14 shows Student 9's performance on daily 7-item quizzes for both experimental conditions of this study. Student 9 was present for 9 out of 12 lessons during single student responding conditions and 12 out of 14 lessons during write-on response card conditions.

**SSR conditions.** During the SSR-1 condition in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 9 answered an average of 6.7 items correctly out of a possible 7 points, with a range of 6 to 7 correct items. During the SSR-2 condition, Student 9's average quiz score was 5.7 with a range of 4 to 7. Student 9's quiz score performance showed a decrease from the first SSR condition to the second. The range of scores varied from the first SSR condition to the second SSR condition. Student 9 was absent for 2 of the 8 SSR-1 sessions and for 1 of the 4 SSR-2 sessions. The mean score for combined SSR sessions for Student 9 was 6.3 with a range of 4 to 7.
Figure 14. Number of correct quiz questions for Student 9 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
Write-on Response Card conditions. During the Write-on Response Card-1 condition, Student 9 earned an average of 6.3 out of a possible 7 points, with a range of 3 to 7 items correct. During the Write-on Response Cards-2 condition, Student 9's average quiz score was 6.4 with a range of 4 to 7. Student 9's mean quiz score for the combined write-on response card conditions was 6.3 correctly answered items with a range of 3 to 7. Student 9's quiz score performance showed a slight increase from the first write-on response card condition to the second write-on response card condition. The range of scores changed only slightly. Student 9 was absent from 1 of the 8 sessions conducted during the Write-on Response Card-1 condition, and 1 of the 6 sessions conducted during Write-on Response Card-2 condition.

Student 10.

Figure 15 shows Student 10's performance on daily 7-item quizzes for both experimental conditions of this study. Student 10 was present for all 12 lessons during single student responding conditions and all 14 lessons during write-on response card conditions.

SSR conditions. During the SSR-1 condition in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 10 answered an average of 6.4 items correctly out of a possible 7 points, with a range of 5 to 7 correct items. During the SSR-2 condition, Student 10's average quiz score was 6.0 with a range of 5 to 7. Student 10's quiz score performance showed a decrease from the first SSR condition to the second. The range of scores remained unchanged from the first SSR condition to the second SSR condition. The mean score for combined SSR sessions for Student 10 was 6.3 with a range of 5 to 7.

Write-on Response Card conditions. During the Write-on Response Card-1 condition, Student 10 earned an average of 5.6 out of a possible 7 points, with a range of 4 to 7
Figure 15. Number of correct quiz questions for Student 10 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
items correct. During the Write-on Response Cards-2 condition, Student 10's average quiz score was 6.2 with a range of 5 to 7. Student 10's mean quiz score for the combined write-on response card conditions was 5.9 correctly answered items with a range of 4 to 7. Student 10's quiz score performance showed an increase from the first write-on response card condition to the second write-on response card condition. The range of scores changed only slightly.

**Student 11**

Figure 16 shows Student 11's performance on daily 7-item quizzes for both experimental conditions of this study. Student 11 was present for 12 out of 12 lessons during single student responding conditions and 14 out of 14 lessons during write-on response card conditions.

**SSR conditions.** During the SSR-1 condition in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 11 answered an average of 5.9 items correctly out of a possible 7 points, with a range of 3 to 7 correct items. During the SSR-2 condition, Student 11's average quiz score was 6.0 with a range of 5 to 7. Student 11's quiz score performance showed a slight increase from the first SSR condition to the second. The range of scores varied slightly from the first SSR condition to the second SSR condition. The mean score for combined SSR sessions for Student 11 was 5.9 with a range of 3 to 7.

**Write-on Response Card conditions.** During the Write-on Response Card-1 condition, Student 11 earned an average of 6.4 out of a possible 7 points, with a range of 5 to 7 items correct. During the Write-on Response Cards-2 condition, Student 11's average quiz score was 6.3 with a range of 5 to 7. Student 11's mean quiz score for the combined write-on response card conditions was 6.4 correctly answered items with a range of 5 to 7. Student 11's quiz score performance showed a slight decrease from the first write-on
Figure 16. Number of correct quiz questions for Student 11 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
response card condition to the second write-on response card condition. The range of scores remained unchanged.

**Student 12**

Figure 17 shows Student 12's performance on daily 7-item quizzes for both experimental conditions of this study. Student 12 was present for 11 out of 12 lessons during single student responding conditions and 10 out of 14 lessons during write-on response card conditions.

**SSR conditions.** During the SSR-1 condition in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 12 answered an average of 6.0 items correctly out of a possible 7 points, with a range of 5 to 7 correct items. During the SSR-2 condition, Student 12's average quiz score was 6.8 with a range of 6 to 7. Student 12's quiz score performance showed an increase from the first SSR condition to the second. The range of scores varied slightly from the first SSR condition to the second SSR condition. Student 12 was absent for 1 of the 8 SSR-1 sessions. The mean score for combined SSR sessions for Student 12 was 6.3 with a range of 6 to 7.

**Write-on Response Card conditions.** During the Write-on Response Card-1 condition, Student 12 earned an average of 6.0 out of a possible 7 points, with a range of 5 to 7 items correct. During the Write-on Response Cards-2 condition, Student 12's average quiz score was 5.7 with a range of 4 to 7. Student 12's mean quiz score for the combined write-on response card conditions was 5.8 correctly answered items with a range of 4 to 7. Student 12's quiz score performance showed a decrease from the first write-on response card condition to the second write-on response card condition. The range of scores changed only slightly. Student 12 was absent from 4 of the 8 sessions conducted during the Write-on Response Card-1 condition.
Figure 17. Number of correct quiz questions for Student 12 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
Student 13

Figure 18 shows Student 13’s performance on daily 7-item quizzes for both experimental conditions of this study. Student 13 was present for 12 out of 12 lessons during single student responding conditions and 14 out of 14 lessons during write-on response card conditions.

SSR conditions. During the SSR-1 condition in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students’ names in the class, Student 13 answered an average of 6.5 items correctly out of a possible 7 points, with a range of 4 to 7 correct items. During the SSR-2 condition, Student 13’s average quiz score was 7.0 with a range of 7. Student 13’s quiz score performance showed a slight increase from the first SSR condition to the second. The range of scores varied from the first SSR condition to the second SSR condition.

The mean score for combined SSR sessions for Student 13 was 6.7 with a range of 4 to 7.

Write-on Response Card conditions. During the Write-on Response Card-1 condition, Student 13 earned an average of 5.9 out of a possible 7 points, with a range of 4 to 7 items correct. During the Write-on Response Card-2 condition, Student 13’s average quiz score was 7.0 with a range of 7. Student 13’s mean quiz score for the combined write-on response card conditions was 6.4 correctly answered items with a range of 4 to 7.

Student 13’s quiz score performance showed an increase from the first write-on response card condition to the second write-on response card condition. The range of scores changed from 4-7 during WORC-1 to a score of 7 for all 6 WORC-2 sessions.

Student 14

Figure 19 shows Student 14’s performance on daily 7-item quizzes for both experimental conditions of this study. Student 14 was present for 11 out of 12 lessons during single student responding conditions and 12 out of 14 lessons during write-on response card conditions.
Figure 18. Number of correct quiz questions for Student 13 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
Figure 19. Number of correct quiz questions for Student 14 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
SSR conditions. During the SSR-1 condition in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 14 answered an average of 5.6 items correctly out of a possible 7 points, with a range of 2 to 7 correct items. During the SSR-2 condition, Student 14's average quiz score was 5.3 with a range of 1 to 7. Student 14's quiz score performance showed a decrease from the first SSR condition to the second. The range of scores varied slightly from the first SSR condition to the second SSR condition. Student 14 was absent for 1 of the 8 SSR-1 sessions. The mean score for combined SSR sessions for Student 14 was 5.5 with a range of 1 to 7.

Write-on Response Card conditions. During the Write-on Response Card-1 condition, Student 14 earned an average of 5.4 out of a possible 7 points, with a range of 2 to 7 items correct. During the Write-on Response Cards-2 condition, Student 14's average quiz score was 4.4 with a range of 3 to 5. Student 14's mean quiz score for the combined write-on response card conditions was 5.0 correctly answered items with a range of 2 to 7. Student 14's quiz score performance showed a decrease from the first write-on response card condition to the second write-on response card condition. The range of scores changed only slightly. Student 14 was absent from 1 of the 8 sessions conducted during the Write-on Response Card-1 condition and 1 of the 6 sessions conducted during WORC-2.

Student 15

Figure 20 shows Student 15's performance on daily 7-item quizzes for both experimental conditions of this study. Student 15 was present for 11 out of 12 lessons during single student responding conditions and 14 out of 14 lessons during write-on response card conditions.
Figure 20: Number of correct quiz questions for Student 15 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
SSR conditions. During the SSR-1 condition in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 15 answered an average of 6.3 items correctly out of a possible 7 points, with a range of 4 to 7 correct items. During the SSR-2 condition, Student 15's average quiz score was 6.5 with a range of 6 to 7. Student 15's quiz score performance showed a slight increase from the first SSR condition to the second. The range of scores varied slightly from the first SSR condition to the second SSR condition. Student 15 was absent for 1 of the 8 SSR-1 sessions. The mean score for combined SSR sessions for Student 15 was 6.4 with a range of 4 to 7.

Write-on Response Card conditions. During the Write-on Response Card-1 condition, Student 15 earned an average of 5.8 out of a possible 7 points, with a range of 4 to 7 items correct. During the Write-on Response Cards-2 condition, Student 15's average quiz score was 6.2 with a range of 5 to 7. Student 15's mean quiz score for the combined write-on response card conditions was 5.9 correctly answered items with a range of 4 to 7. Student 15's quiz score performance showed an increase from the first write-on response card condition to the second write-on response card condition. The range of scores changed only slightly.

Student 16

Figure 21 shows Student 16's performance on daily 7-item quizzes for both experimental conditions of this study. Student 16 was present for 10 out of 12 lessons during single student responding conditions and 12 out of 14 lessons during write-on response card conditions.

SSR conditions. During the SSR-1 condition in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 16 answered an average of 6.7 items correctly out of a possible 7 points, with a range of 6 to 7 correct items. During the SSR-
Figure 21. Number of correct quiz questions for Student 16 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
2 condition, Student 16's average quiz score was 6.3 with a range of 6 to 7. Student 16's quiz score performance showed a decrease from the first SSR condition to the second. The range of scores remained unchanged from the first SSR condition to the second SSR condition. Student 16 was absent for 1 of the 8 SSR-1 sessions and 1 of the 4 SSR-2 sessions. The mean score for combined SSR sessions for Student 16 was 6.6 with a range of 6 to 7.

Write-on Response Card conditions. During the Write-on Response Card-1 condition, Student 16 earned an average of 6.4 out of a possible 7 points, with a range of 5 to 7 items correct. During the Write-on Response Cards-2 condition, Student 16's average quiz score was 6.2 with a range of 5 to 7. Student 16's mean quiz score for the combined write-on response card conditions was 6.3 correctly answered items with a range of 5 to 7. Student 16's quiz score performance showed a slight decrease from the first write-on response card condition to the second write-on response card condition. The range of scores remained unchanged. Student 16 was absent from 1 of the 8 sessions conducted during the Write-on Response Card-1 condition and 1 of the 6 sessions conducted during WORC-2 condition.

Student 17

Figure 22 shows Student 17's performance on daily 7-item quizzes for both experimental conditions of this study. Student 17 was present for 10 out of 12 lessons during single student responding conditions and 14 out of 14 lessons during write-on response card conditions.

SSR conditions. During the SSR-1 condition in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 17 answered an average of 6.7 items correctly out of a possible 7 points, with a range of 5 to 7 correct items. During the SSR-2 condition, Student 17's average quiz score was 6.7 with a range of 6 to 7. Student 17's
Figure 22. Number of correct quiz questions for Student 17 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
quiz score performance remained unchanged from the first SSR condition to the second. The range of scores varied slightly from the first SSR condition to the second SSR condition. Student 17 was absent for 1 of the 8 SSR-1 sessions and 1 of the 4 sessions conducted during SSR-2. The mean score for combined SSR sessions for Student 17 was 6.7 with a range of 5 to 7.

**Write-on Response Card conditions.** During the Write-on Response Card-1 condition, Student 17 earned an average of 6.1 out of a possible 7 points, with a range of 4 to 7 items correct. During the Write-on Response Cards-2 condition, Student 17's average quiz score was 6.8 with a range of 6 to 7. Student 17's mean quiz score for the combined write-on response card conditions was 6.4 correctly answered items with a range of 6 to 7. Student 17's quiz score performance showed an increase from the first write-on response card condition to the second write-on response card condition. The range of scores changed only slightly.

**Student 18**

Figure 23 shows Student 18's performance on daily 7-item quizzes for both experimental conditions of this study. Student 18 was present for 9 out of 12 lessons during single student responding conditions and 12 out of 14 lessons during write-on response card conditions.

**SSR conditions.** During the SSR-1 condition in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 18 answered an average of 7.0 items correctly out of a possible 7 points, with a range of 7 correct items. During the SSR-2 condition, Student 18's average quiz score was 7.0 with a range of 7. Student 18's quiz score performance remained unchanged from the first SSR condition to the second. The range of scores did not vary from the first SSR condition to the second SSR condition. Student 18 was absent for 1 of the 8 sessions conducted during SSR-1 and for 2 of the 4
Figure 23. Number of correct quiz questions for Student 18 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
SSR-2 sessions. The mean score for combined SSR sessions for Student 18 was 7.0 with a range of 7.

**Write-on Response Card conditions.** During the Write-on Response Card-1 condition, Student 18 earned an average of 6.3 out of a possible 7 points, with a range of 4 to 7 items correct. During the Write-on Response Cards-2 condition, Student 18's average quiz score was 6.2 with a range of 4 to 7. Student 18's mean quiz score for the combined write-on response card conditions was 6.3 correctly answered items with a range of 4 to 7. Student 18's quiz score performance showed a slight decrease from the first write-on response card condition to the second write-on response card condition. The range of scores remained unchanged. Student 18 was absent from 1 of the 8 sessions conducted during the Write-on Response Card-1 condition and 1 of the 6 sessions conducted during WORC-2.

**Student 19**

Figure 24 shows Student 19's performance on daily 7-item quizzes for both experimental conditions of this study. Student 19 was present for 11 out of 12 lessons during single student responding conditions and 14 out of 14 lessons during write-on response card conditions.

**SSR conditions.** During the SSR-1 condition in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 19 answered an average of 5.0 items correctly out of a possible 7 points, with a range of 3 to 7 correct items. During the SSR-2 condition, Student 19's average quiz score was 5.5 with a range of 3 to 7. Student 19's quiz score performance showed a slight increase from the first SSR condition to the second. The range of scores did not vary from the first SSSR condition to the second SSR condition. Student 19 was absent for 1 of the 8 SSR-1 sessions. The mean score for combined SSR sessions for Student 19 was 5.2 with a range of 3 to 7.
Figure 24. Number of correct quiz questions for Student 19 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
Write-on Response Card conditions. During the Write-on Response Card-1 condition, Student 19 earned an average of 5.3 out of a possible 7 points, with a range of 3 to 7 items correct. During the Write-on Response Cards-2 condition, Student 19's average quiz score was 4.5 with a range of 0 to 7. Student 19's mean quiz score for the combined write-on response card conditions was 4.9 correctly answered items with a range of 0 to 7. Student 19's quiz score performance showed a decrease from the first write-on response card condition to the second write-on response card condition. The range of scores changed from 3 to 7 during WORC-1 to 0 to 7 in WORC-2.

Student 20

Figure 25 shows Student 20's performance on daily 7-item quizzes for both experimental conditions of this study. Student 20 was present for 9 out of 12 lessons during single student responding conditions and 11 out of 14 lessons during write-on response card conditions.

SSR conditions. During the SSR-1 condition in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 20 answered an average of 6.7 items correctly out of a possible 7 points, with a range of 6 to 7 correct items. During the SSR-2 condition, Student 20's average quiz score was 6.0 with a range of 5 to 7. Student 20's quiz score performance showed a decrease from the first SSR condition to the second. The range of scores varied slightly from the first SSR condition to the second SSR condition. Student 20 was absent for 2 of the 8 Baseline-1 sessions and for 1 of the 4 SSR-2 sessions. The mean score for combined SSR sessions for Student 20 was 6.4 with a range of 5 to 7.

Write-on Response Card conditions. During the Write-on Response Card-1 condition, Student 20 earned an average of 6.8 out of a possible 7 points, with a range of 6 to 7 items correct. During the Write-on Response Cards-2 condition, Student 20's average
Figure 25. Number of correct quiz questions for Student 20 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
quiz score was 6.6 with a range of 6 to 7. Student 20's mean quiz score for the combined write-on response card conditions was 6.7 correctly answered items with a range of 6 to 7. Student 20's quiz score performance showed a slight decrease from the first write-on response card condition to the second write-on response card condition. The range of scores remained unchanged. Student 20 was absent from 2 of the 8 sessions conducted during the Write-on Response Card-1 condition and from 1 of the 6 sessions conducted during WORC-2.

**Student 21**

Figure 26 shows Student 21's performance on daily 7-item quizzes for both experimental conditions of this study. Student 21 was present for 12 out of 12 lessons during single student responding conditions and 13 out of 14 lessons during write-on response card conditions.

**SSR conditions.** During the SSR-1 condition in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 21 answered an average of 5.4 items correctly out of a possible 7 points, with a range of 4 to 7 correct items. During the SSR-2 condition, Student 21's average quiz score was 6.0 with a range of 5 to 7. Student 21's quiz score performance showed an increase from the SSR-1 condition to the second. The range of scores varied slightly from the first SSR condition to the second SSR condition. The mean score for combined SSR sessions for Student 1 was 5.6 with a range of 4 to 7.

**Write-on Response Card conditions.** During the Write-on Response Card-1 condition, Student 21 earned an average of 5.7 out of a possible 7 points, with a range of 5 to 7 items correct. During the Write-on Response Cards-2 condition, Student 21's average quiz score was 5.7 with a range of 4 to 7. Student 21's mean quiz score for the combined write-on response card conditions was 5.7 correctly answered items with a range of 4 to 7. Student 21's quiz score performance remained unchanged from the first write-on
Figure 26. Number of correct quiz questions for Student 21 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
response card condition to the second write-on response card condition. The range of scores changed only slightly. Student 21 was absent from 1 of the 8 sessions conducted during the Write-on Response Card-1 condition.

**Student 22**

Figure 27 shows Student 22's performance on daily 7-item quizzes for both experimental conditions of this study. Student 22 was present for 12 out of 12 lessons during single student responding conditions and 11 out of 14 lessons during write-on response card conditions.

**SSR conditions.** During the SSR-1 condition in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 22 answered an average of 5.1 items correctly out of a possible 7 points, with a range of 4 to 7 correct items. During the SSR-2 condition, Student 22's average quiz score was 4.3 with a range of 2 to 6. Student 22's quiz score performance showed a decrease from the SSR-1 condition to the second. The range of scores varied from the first SSR condition to the second SSR condition. The mean score for combined SSR sessions for Student 22 was 4.8 with a range of 2 to 7.

**Write-on Response Card conditions.** During the Write-on Response Card-1 condition, Student 22 earned an average of 5.0 out of a possible 7 points, with a range of 4 to 7 items correct. During the Write-on Response Cards-2 condition, Student 22's average quiz score was 5.6 with a range of 4 to 7. Student 22's mean quiz score for the combined write-on response card conditions was 5.3 correctly answered items with a range of 4 to 7. Student 22's quiz score performance showed an increase from the first write-on response card condition to the second write-on response card condition. The range of scores remained unchanged. Student 22 was absent from 2 of the 8 sessions conducted during the Write-on Response Card-1 condition and for 1 of the 6 sessions conducted during WORC-2.
Figure 27. Number of correct quiz questions for Student 22 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
Figure 28 shows Student 23’s performance on daily 7-item quizzes for both experimental conditions of this study. Student 23 was present for 9 out of 12 lessons during single student responding conditions and 12 out of 14 lessons during write-on response card conditions.

**SSR conditions.** During the SSR-1 condition in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 23 answered an average of 3.4 items correctly out of a possible 7 points, with a range of 0 to 5 correct items. During the SSR-2 condition, Student 23’s average quiz score was 3.0 with a range of 3. Student 23’s quiz score performance showed a decrease from the first SSR condition to the second. The range of scores varied from the first SSR condition to the second SSR condition. Student 1 was absent for 1 of the 8 sessions conducted during SSR-1 and for 2 of the 4 SSR-2 sessions. The mean score for combined SSR sessions for Student 23 was 3.4 with a range of 0 to 5.

**Write-on Response Card conditions.** During the Write-on Response Card-1 condition, Student 23 earned an average of 3.9 out of a possible 7 points, with a range of 2 to 6 items correct. During the Write-on Response Cards-2 condition, Student 23’s average quiz score was 2.6 with a range of 1 to 4. Student 23’s mean quiz score for the combined write-on response card conditions was 3.3 correctly answered items with a range of 1 to 6. Student 23’s quiz score performance showed a decrease from the first write-on response card condition to the second write-on response card condition. The range of scored varied between WORC-1 and WORC-2. Student 23 was absent from 1 of the 8 sessions conducted during the Write-on Response Card-1 condition and 1 of the 6 sessions conducted during WORC-2.
Figure 28. Number of correct quiz questions for Student 23 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
Student 24

Figure 29 shows Student 24's performance on daily 7-item quizzes for both experimental conditions of this study. Student 24 was present for 10 out of 12 lessons during single student responding conditions and 14 out of 14 lessons during write-on response card conditions.

SSR conditions. During the SSR-1 condition in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 24 answered an average of 5.8 items correctly out of a possible 7 points, with a range of 5 to 7 correct items. During the SSR-2 condition, Student 24's average quiz score was 4.5 with a range of 1 to 7. Student 24's quiz score performance showed a decrease from the first SSR condition to the second. The range of scores varied from the first SSR condition to the second SSR condition. Student 24 was absent for 2 of the 8 SSR-1 sessions. The mean score for combined SSR sessions for Student 24 was 5.3 with a range of 1 to 7.

Write-on Response Card conditions. During the Write-on Response Card-1 condition, Student 24 earned an average of 5.6 out of a possible 7 points, with a range of 4 to 7 items correct. During the Write-on Response Cards-2 condition, Student 24's average quiz score was 6.7 with a range of 5 to 7. Student 24's mean quiz score for the combined write-on response card conditions was 6.1 correctly answered items with a range of 4 to 7. Student 24's quiz score performance showed an increase from the first write-on response card condition to the second write-on response card condition. The range of scores changed only slightly.
Figure 29. Number of correct quiz questions for Student 24 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
Student 25

Figure 30 shows Student 25's performance on daily 7-item quizzes for both experimental conditions of this study. Student 25 was present for 10 out of 12 lessons during single student responding conditions and 12 out of 14 lessons during write-on response card conditions.

SSR conditions. During the SSR-1 in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 25 answered an average of 3.5 items correctly out of a possible 7 points, with a range of 2 to 6 correct items. During the SSR-2 condition, Student 25's average quiz score was 3.0 with a range of 1 to 5. Student 25's quiz score performance showed a decrease from the first SSR condition to the second. The range of scores varied from the first SSR condition to the second SSR condition. Student 25 was absent for 2 of the 4 SSR-2 sessions. The mean score for combined SSR sessions for Student 25 was 3.4 with a range of 1 to 6.

Write-on Response Card conditions. During the Write-on Response Card-1 condition, Student 25 earned an average of 3.0 out of a possible 7 points, with a range of 0 to 4 items correct. During the Write-on Response Cards-2 condition, Student 25's average quiz score was 3.3 with a range of 2 to 5. Student 25's mean quiz score for the combined write-on response card conditions was 3.2 correctly answered items with a range of 0 to 5. Student 25's quiz score performance showed a slight increase from the first write-on response card condition to the second write-on response card condition. The range of scores varied between WORC-1 and WORC-2. Student 25 was absent from 2 of the 8 sessions conducted during the Write-on Response Card-1 condition.

Student 26

Figure 31 shows Student 26's performance on daily 7-item quizzes for both experimental conditions of this study. Student 26 was present for 8 out of 12 lessons
Figure 30. Number of correct quiz questions for Student 25 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
Figure 31. Number of correct quiz questions for Student 26 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
during single student responding conditions and 12/14 lessons during write-on response card conditions.

**SSR conditions.** During the SSR-1 condition in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 26 answered an average of 3.2 items correctly out of a possible 7 points, with a range of 0 to 5 correct items. During the SSR-2 condition, Student 26's average quiz score was 3.0 with a range of 2 to 4. Student 26's quiz score performance showed a slight decrease from the first SSR condition to the second. The range of scores varied from the first SSR condition to the second SSR condition. Student 26 was absent for 3 of the 8 sessions conducted during SSR-1 and for 1 of the 4 SSR-2 sessions. The mean score for combined SSR sessions for Student 26 was 3.1 with a range of 0 to 5.

**Write-on Response Card conditions.** During the Write-on Response Card-1 condition, Student 26 earned an average of 2.9 out of a possible 7 points, with a range of 0 to 6 items correct. During the Write-on Response Cards-2 condition, Student 26's average quiz score was 3.0 with a range of 1 to 5. Student 26's mean quiz score for the combined write-on response card conditions was 2.9 correctly answered items with a range of 0 to 6. Student 26's quiz score performance showed a slight decrease from the first write-on response card condition to the second write-on response card condition. The range of scores changed from WORC-1 to WORC-2. Student 26 was absent from 1 of the 8 sessions conducted during the Write-on Response Card-1 condition and 1 of 6 sessions conducted during WORC-2.
Student 27

Figure 32 shows Student 27's performance on daily 7-item quizzes for both experimental conditions of this study. Student 27 was present for 12 out of 12 lessons during single student responding conditions and 14 out of 14 lessons during write-on response card conditions.

**Baseline conditions.** During the Baseline-1 phase in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 27 answered an average of 4.4 items correctly out of a possible 7 points, with a range of 3 to 7 correct items. During the Baseline-2 condition, Student 27's average quiz score was 4.3 with a range of 3 to 5. Student 27's quiz score performance showed a slight decrease from the first baseline phase to the second. The range of scores varied from the first baseline condition to the second baseline condition. The mean score for combined baseline sessions for Student 27 was 4.3 with a range of 3 to 7.

**Write-on Response Card conditions.** During the Write-on Response Card-1 condition, Student 27 earned an average of 3.5 out of a possible 7 points, with a range of 0 to 7 items correct. During the Write-on Response Cards-2 condition, Student 27's average quiz score was 4.3 with a range of 3 to 7. Student 27's mean quiz score for the combined write-on response card conditions was 3.9 correctly answered items with a range of 0 to 7. Student 27's quiz score performance showed an increase from the first write-on response card condition to the second write-on response card condition. The range of scores changed from WORC-1 to WORC-2.

Student 28

Figure 33 shows Student 28's performance on daily 7-item quizzes for both experimental conditions of this study. Student 28 was present for 11 out of 12 lessons
Figure 32. Number of correct quiz questions for Student 27 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
Figure 33. Number of correct quiz questions for Student 28 during both Single Student Responding (SSR) and Write-on Response Card (WORC) conditions.
during single student responding conditions and 14 out of 14 lessons during write-on response card conditions.

**SSR conditions.** During the SSR-1 condition in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, Student 28 answered an average of 6.1 items correctly out of a possible 7 points, with a range of 5 to 7 correct items. During the SSR-2 condition, Student 28's average quiz score was 6.3 with a range of 5 to 7. Student 28's quiz score performance showed a slight increase from the first SSR condition to the second. The range of scores remained unchanged from the first SSR condition to the second SSR condition. Student 28 was absent for 1 of the 8 SSR-1 sessions. The mean score for combined SSR sessions for Student 28 was 6.2 with a range of 5 to 7 correct items.

**Write-on Response Card conditions.** During the WORC-1 condition, Student 28 earned an average of 6.3 out of a possible 7 points, with a range of 5 to 7 items correct. During the WORC-2 condition, Student 28's average quiz score was 6.8 with a range of 6 to 7. Student 28's mean quiz score for the combined write-on response card conditions was 6.5 correctly answered items with a range of 5 to 7. Student 28's quiz score performance showed a slight increase from the first write-on response card condition to the second write-on response card condition. The range of scores changed only slightly.
Table 5 displays the average quiz score for each student by condition. The group average quiz score for each condition of the study is presented below. Also presented is the average score of combined single student responding and write-on response card conditions.

**SSR conditions.** During the SSR-1 condition of the study, in which students were individually called upon to answer questions by the teacher from a preselected random list containing all of the students' names in the class, the group average quiz score was 5.4 items correct out of a possible 7 items with a range of 0 to 7 correct items. During the SSR-2 condition of the study, the group average quiz score was 5.0 with a range of 0 to 7 correct items. The group average score for the combined SSR conditions was 5.3 with a range of 0 to 7 correctly answered items. The group's average quiz score performance decreased during the second SSR condition as compared to the first.

**Write-on response cards condition.** During the Write-on Response Cards condition of the study, the group average quiz score was 5.4 items correct out of a possible 7 items with a range of 0 to 7 items correct. During the Write-on response cards-2 condition, the group average quiz score was 4.1 with a range of 0 to 7 items correct. The group average quiz score for the combined write-on response cards condition was 4.7 correctly answered items with a range of 0 to 7 items correct. The group's average quiz score performance decreased during the second write-on response cards condition as compared to the first. The average quiz score for the group was 4.7 correct items with a range of 0
Table 5

Average Quiz Score for Each Student By Condition

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<th>WORC-2 (6)</th>
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Mean 5.5      5.4      5.0      4.1      5.3      4.7

Note. Numbers in parentheses indicate the total number of sessions per condition.
to 7 during combined write-on response cards conditions as compared to the score
5.3 items correct with a range of 0 to 7 during combined SSR conditions, showing a
decrease from combined WORC conditions as compared to SSR conditions.

Consumer Satisfaction

Student Preference

At the conclusion of the study, students were orally asked questions from a
questionnaire (see Appendix G). Twenty-four of the twenty-eight total participants were
present on the day of the exit interview (Table 6). All four students targeted for
disruptive and on-task behavior observation stated that they like using write-on response
cards to answer the questions over single student responding. Three out of the four
targeted students stated that using write-on response cards helped them to do better on the
daily quizzes, while one student was not sure which method helped his performance most
on the quizzes.

Teacher Preference

At the conclusion of the study, teachers were asked to answer questions from a
questionnaire (see Appendix H). The two classroom teachers whose classes were
involved in the study stated they perceived the use of write-on response cards over single
student responding as the students' favorite way of responding during the science lessons.
Both teachers also indicated that they felt the use of write-on response cards helped the
students the most, as well as get the best grades on the quizzes. The classroom teachers
both stated that they noticed more appropriate classroom behaviors and more on-task
behaviors from all of the students participating in the study with the use of write-on
response cards over single student responding.
<table>
<thead>
<tr>
<th>Question</th>
<th>Single Student Response (SSR)</th>
<th>Write-on Response Card (WORC)</th>
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<tr>
<td>2. Which way of answering did you feel helped you most to understand?</td>
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<td>19</td>
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<td>3. Which of answering the questions helped you get the best grade on the quiz?</td>
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CHAPTER 5

DISCUSSION

The purpose of this research study was to investigate the effects of single student responding and write-on response cards on the on-task and disruptive classroom behaviors as well as the academic performance of elementary students at-risk for academic failure during whole class science instruction. Two experimental conditions were used in this study; single student responding and write-on response cards. This chapter contains a discussion of the results obtained relative to the five research questions, limitations of the study, implications for the classroom, and directions for future research. This chapter concludes with a summary of this study.

**Research Question 1**

During which condition, single student responding or write-on response cards, will students demonstrate higher percentages of on-task behavior during whole class science instruction? All four of the targeted students demonstrated higher mean percentages of on-task behavior during the write-on response card conditions as compared to the single student responding conditions (SSR 1 and 2). The average percentage of combined observed intervals that all target students demonstrated on-task behavior was 43% during single student responding conditions and 66% during write-on response card conditions; an increase of 23% of on-task behavior during write-on response card conditions. These findings are similar to on/off-task behavior and the use of response cards found by Gardner, et al., 1993.
Student 1 demonstrated on-task behaviors an average of 46% of the observed intervals for the combined single student responding conditions (SSR 1 and 2), and an average of 70% on-task behaviors of the observed intervals for the combined write-on response card conditions. This was an increase of 24% on-task behaviors from the combined SSR conditions to the combined write-on response card conditions. This increase of on-task behaviors during WORC conditions revealed a functional relationship demonstrated between the use of write-on response cards and higher percentages of on-task behaviors. Student 1 did not participate in three of the eight sessions during the initial write-on response card condition, nor did he participate in two of the four sessions in the Baseline-2 condition due to absences. Looking at the level and trend of previous and subsequent on-task behaviors, this absenteeism did not appear to significantly effect the outcome of the data.

Student 2 demonstrated on-task behaviors an average of 32% of the observed intervals for the combined single student responding conditions (SSR 1 and 2), and an average of 61% on-task behaviors of the observed intervals for the combined write-on response card conditions. This was an increase of 29% of on-task behaviors from the combined SSR conditions to the combined WORC conditions. The increase in on-task behaviors during the write-on response card conditions shows a functional relationship between the use of write-on response cards and on-task behaviors.

Student 3 demonstrated on-task behaviors an average of 50% of the observed intervals for the combined single student responding conditions (SSR 1 and 2), and an average of 64% on-task behaviors of the observed intervals for the combined write-on response card conditions. This was an increase of 14% of on-task behaviors from the combined SSR conditions to the combined WORC conditions. This increase in on-task behaviors revealed a functional relationship between the use of write-on response cards and on-task behaviors for Student 3.
Student 4 demonstrated on-task behaviors an average of 45% of the observed intervals for the combined single student responding conditions (SSR 1 and 2), and an average of 70% on-task behaviors of the observed intervals for the combined write-on response card conditions. This was an increase of 25% of on-task behaviors from the combined SSR conditions to the combined WORC conditions. This increase of 25% of on-task behaviors demonstrates a functional relationship between the use of write-on response cards and on-task behaviors for Student 4.

In summary, a functional relationship was demonstrated between the use of write-on response cards and increase on-task behaviors for all four of the targeted students, coinciding with the findings in the literature (Gardner, et al., 1993). This increase in on-task behavior during response card conditions may be attributable to the type of topographical response expected from each student after questions are posed by the teacher during response card conditions. The frequency of responding may also play a role in keeping students on-task. The frequency of responding was not a manipulated variable in this study, so no definitive statements can be made. Since students were expected to write on the response card and hold up their response card after each question, this might have prompted students to sit facing forward, which is more conducive to completing the frequent writing tasks. Single student responding did not require this behavior in order for students to respond, allowing students to sit in a variety of positions and still respond appropriately student responding.

Research Question Two

During which condition, single student responding or write-on response cards, will students demonstrate lower percentages of disruptive classroom behaviors during science instruction? Two of the four students targeted for data collection of disruptive classroom demonstrated higher percentages of disruptive classroom behavior during single student responding conditions (SSR 1 and 2), as compared to the write-on response card
conditions, and two of the four students targeted for data collection of disruptive classroom behaviors demonstrated higher percentages of disruptive classroom behaviors during the write-on response card conditions. The average percentage of combined observed intervals that all target students demonstrated disruptive classroom behavior was 17%, with a range of 0% to 40%, during single student responding conditions and 16%, with a range of 7% to 33%, during write-on response cards conditions; an decrease of 1% of disruptive classroom behavior during write-on response cards conditions as compared to single student responding conditions. Although there was a slight decrease in the percentage of disruptive behavior during write-on response cards conditions, the findings were not significant. Discussed below are the results of all four target students.

Student 1 demonstrated disruptive classroom behavior an average of 16% of the observed intervals for the combined single student responding conditions (SSR 1 and 2), and an average of 18% disruptive classroom behavior of the observed intervals for the combined write-on response card conditions. This was an increase of 2% disruptive classroom behavior from the combined SSR conditions to the combined WORC conditions. This slight increase of disruptive classroom behavior revealed no functional relationship between the use of single student responding or the use of write-on response cards and disruptive classroom behavior. Due to absences, Student 1 did not participate in three of the eight sessions during the initial write-on response card condition, nor did he participate in two of the four sessions in the SSR-2 condition. Looking at the level and trend of previous and subsequent disruptive classroom behaviors, this absenteeism did not appear to significantly effect the outcome of the data.

Student 2 demonstrated disruptive classroom behavior an average of 14% of the observed intervals for the combined single student responding conditions (SSR 1 and 2), and an average of 9% disruptive classroom behavior of the observed intervals for the combined write-on response card conditions. This was an increase of 5% appropriate
classroom behavior from the combined SSR conditions to the combined WORC conditions. This improvement was meaningful for Student 2 who tended to demonstrate more disruptive behaviors during whole class science instruction during single student responding; the use of write-on response cards involved the student in the lesson more often, decreasing disruptive classroom behaviors and increasing appropriate classroom behaviors.

Student 3 demonstrated disruptive classroom behavior an average of 15% of the observed intervals for the combined single student responding conditions (SSR 1 and 2), and an average of 17% disruptive classroom behavior of the observed intervals for the combined write-on response card conditions. This was a decrease of 2% disruptive classroom behavior during the combined SSR conditions as compared to the combined WORC conditions. This slight decrease of disruptive classroom behavior revealed no functional relationship between the use of single student responding or the use of write-on response cards and disruptive classroom behaviors for Student 3.

Student 4 demonstrated disruptive classroom behaviors an average of 23% of the observed intervals for the combined single student responding conditions (SSR 1 and 2), and an average of 18% disruptive classroom behavior of the observed intervals for the combined write-on response card conditions. This was an decrease of 5% disruptive classroom behavior from the combined SSR conditions to the combined WORC conditions. This slight decrease of disruptive classroom behavior revealed no clear functional relationship between the use of single student responding or the use of write-on response cards and disruptive classroom behaviors for Student 4.

In summary, a functional relationship was not demonstrated between the use of write-on response cards and a decrease in disruptive classroom behavior even though there was some overall improvement for Students 2 and 4 during response cards conditions. There was too much overlap of data point and in stability to claim a functional relationship.
Students 1 and 3 demonstrated lower percentages of disruptive classroom behavior with the single student responding method of classroom instruction but similarly a functional relationship was not seen.

Overall, after examining the decreases in disruptive behavior for Students 2 and 4 of 5% respectively, with the use of write-on response cards and increases of disruptive classroom behaviors of Students 1 and 3 of 2% respectively, with the use of write-on response cards, it can be said that a functional relationship was not demonstrated between the use of write-on response cards and disruptive classroom behaviors of the target students or with the use of single student responding and disruptive classroom behavior. The fact that in both conditions, response cards and single student responding, each student needed to be prepared to respond to each teacher posed questions. This may have maintained appropriate student behavior across conditions. In previous response card studies (Gardner, et al., 1994; Narayan, et al., 1990) response card conditions have been compared to handraising conditions where only one of the students who raised their hand after the teacher asked a question was called upon. If a student did not raise her/his hand, then the student knew they would not be called upon. This predictability permitted students to not be accountable during instruction, even though they were held accountable on subsequent quizzes and tests. However, in single student responding, the students never knew who was going to be called upon. Therefore, there was increased accountability to be prepared to respond during instruction. The result of this unpredictability in instruction is consistent with the literature in indiscriminable contingencies and teacher effectiveness (Heward, 1994; Gardner, et al., 1994; Narayan, et al., 1990; Gettinger, 1988; Brophy, 1983; Good, 1979).

The results of this study suggest that student uncertainty about when she/he might be called upon to respond to a teacher question can be a powerful tool for maintaining appropriate classroom behavior. In fact, there was no significant difference between
Single Student Responding (unpredictable) and Write-on Response Card conditions (predictable). Write-on response cards were predictable in that each student was expected to respond to each teacher posed question. Both conditions seem to promote relatively high levels of appropriate behavior. Students are aware of the expectation that they are individually responsible for the information. The students are then held accountable in both conditions during instruction, but in very different ways. Single Student Responding (SSR) holds students accountable with unexpected “spot checks” for each student, while Write-on Response Cards (WORC) holds students accountable on each question. In previous studies, in which handraising was used during instruction, the only time students were held accountable was on the quizzes. The delayed accountability of quizzes does not appear to be as strong of a contingency as the immediate accountability found in SSR and WORC. This variable of different types of student accountability during instruction needs to be further investigated.

**Research Question Three**

During which condition, single student responding or write-on response cards, will students demonstrate a higher academic performance on daily quizzes? Three of the four targeted students demonstrated a higher academic performance on the daily quiz during single student responding conditions (SSR 1 and 2), as compared to the write-on response card conditions, and only one of the four targeted students demonstrated a higher academic performance on the daily quizzes during the write-on response card conditions. The combined average daily quiz scores for all four target students was 4.6 out of a possible 7 correct items during single student responding conditions and 4.6 out of a possible 7 correct items during write-on response card conditions, showing no overall difference in academic performance on the daily quiz from the single student responding conditions (SSR 1 and 2) and write-on response card conditions. This differs from the findings in the literature which demonstrate a functional relationship between the use of
response cards and an increase in academic performance (Wheatley, 1986; Narayan, et al., 1990; Gardner, Heward & Grossi, 1994; Sweeney, et al., 1992; Cavanaugh, 1992). Discussed below are the results of the group and three students averaging low, medium and high scores on the daily quizzes.

The group scored an average 5.3 out of a possible 7 correct items for the combined single student responding conditions (SSR 1 and 2), and an average 4.7 out of a possible 7 items correct for the combined write-on response card conditions. This was a decrease of .6 correct items from the combined baseline conditions to the combined intervention conditions. The group's quiz scores in SSR-1 ranged from 0 to 7 correct items; from 0 to 7 correct items in Write-on Response Card-1 condition; from 0 to 7 correct items in SSR-2; and from 0 to 7 items correct in Write-on Response Card-2 condition. This decrease of .6 items correct revealed no functional relationship between write-on response cards and higher academic performance on daily quizzes.

An example of a student scoring low across conditions is Student 26. Student 26 scored an average 3.1 out of a possible 7 correct items for the combined single student responding conditions (SSR 1 and 2), and an average 2.9 out of a possible 7 items correct for the combined write-on response card conditions. This was a decrease of .2 correct items from the combined SSR conditions to the combined intervention conditions. Student 26's quiz scores in SSR-1 ranged from 0 to 5 correct items; from 0 to 6 correct items in Write-on Response Card-1 condition; from 2 to 4 correct items in SSR-2; and from 1 to 5 items correct in Write-on Response Card-2 condition. This decrease of .2 items correct revealed no functional relationship between write-on response cards and higher academic performance on daily quizzes.

An example of a student scoring mid-range across conditions is Student 6. Student 6 scored an average 5 out of a possible 7 correct items for the combined single student responding conditions (SSR 1 and 2), and an average 5.6 out of a possible 7 items correct.
for the combined write-on response card conditions. This was an increase of .6 correct items from the combined SSR conditions to the combined intervention conditions.

Student 6's quiz scores in SSR-1 ranged from 3 to 7 correct items; from 2 to 7 correct items in Write-on Response Card-1 condition; from 3 to 6 correct items in SSR-2; and from 5 to 7 items correct in Write-on Response Card-2 condition. There was a slight increase in the number of items correct during the combined write-on response card conditions, this increase of .6 items correct would have taken the student from an average score of 71% to an average score of 80%.

An example of a student with high academic performance across conditions is Student 8. Student 8 scored an average 6.4 out of a possible 7 correct items for the combined single student responding conditions (SSR 1 and 2), and an average 6.9 out of a possible 7 items correct for the combined write-on response card conditions. This was an increase of .5 correct items from the combined baseline conditions to the combined intervention conditions. Student 8's quiz scores in SSR-1 ranged from 4 to 7 correct items; from 6 to 7 correct items in Write-on Response Card-1 condition; 6 correct items in SSR-2; and 7 items correct in Write-on Response Card-2 condition. There was a slight increase in the number of items correct during the combined write-on response card conditions. This increase of .5 items correct would have taken the student from an average score of 91% to an average score of 99%.

Possible reasons these results were obtained: ceiling effect, both strategies might promote student learning, students pay attention to avoid embarrassment of being asked a question and not knowing the answer.

Ceiling effect. The quiz was kept to a maximum 7 questions in order for all students to be able to finish the lesson on time. This could have produced a ceiling effect. Students could score no better than 7 points per quiz, which may reflect the minimum levels gained by some students.
Both strategies might promote student learning. Sixteen students scored higher on the daily quizzes for the combined baseline conditions, and 11 students scored higher on daily quizzes for the combined WORC conditions. One student showed no difference between combined baseline condition scores and WORC condition scores. This may indicate that both strategies promote student learning.

Students pay attention to avoid embarrassment. Which students were to respond to teacher posed questions during SSR was unpredictable. Responding to every teacher posed question was required during WORC conditions. The unpredictability of responding during SSR may have lead students to pay increased attention during instruction to avoid embarrassment of not knowing the correct answer if called upon. The embarrassment factor was kept to a minimum during WORC conditions because students were allowed to look on their peers’ response card if they could not remember the answer to the question. This possible increase in paying attention could have lead to higher rates of on-task and appropriate classroom behaviors.

In summary the combined average daily quiz scores for all students was 5.3 out of a possible 7 correct items during single student responding conditions and 4.7 out of a possible 7 correct items during write-on response card conditions, showing a decrease of .6 correct items in academic performance on the daily quiz from the single student responding conditions (Baselines 1 and 2) and write-on response card conditions, showing no functional relationship between the use of write-on response cards and higher academic performance on daily quizzes. This differs from the findings in the literature which demonstrate a functional relationship between the use of response cards and an increase in academic performance (Wheatley, 1986; Narayan, et al., 1990; Gardner, et al., 1994; Sweeney, et al., 1992; Cavanaugh, 1992).
Research Question Four

When asked her/his opinion after the study, which method of responding will students prefer, single student responding or write-on response cards? Twenty-five of the 28 students were available for individual interviews regarding their preference of participating in the whole class science lessons five days after the last day of the intervention. Twenty of the 25 students indicated that they preferred the use of write-on response cards over single student responding as their favorite way of responding during whole class science instruction; 5 students preferred single student responding. Nineteen out of the 25 students felt that the use of write-on response cards helped them to understand the lesson better than single student responding; 6 felt single student responding helped them to understand the lesson better than the use of write-on response cards. Interestingly, 13 of the 25 students indicated that the use of write-on response cards helped them to get better scores on the daily quizzes; 10 indicated that they felt single student responding helped them to get a better score on the daily quiz, and 2 students were undecided which method helped them to get a better score on the daily quiz.

In summary, 20 out of 25 students preferred the use of write-on response cards over the single student responding method of participation in whole class science instruction; 19 out of 25 students felt the use of write-on response cards helped them to understand the lesson better, and 13 out of 25 students felt they got better grades on the quizzes as a result of the using write-on response cards.

Research Question Five

When asked her/his opinion after the study, which method of responding will teachers prefer, single student responding or write-on response cards? Both teachers whose classes participated in the study indicated in their individual interview that they preferred the use of write-on response cards over single student responding during the whole class
science instruction. Both teachers indicated that with single student responding, only one student could participate, while with the use of write-on response cards, all students could participate in the lesson.

When asked which method they perceived the students as preferring both teachers responded that they perceived the students to prefer the use of write-on response cards over single student responding.

When asked what they liked about single student responding, both teachers indicated that they thought student activity was more controlled with single student responding over write-on response cards because with write-on response cards, students could look on their neighbor's response card if they weren't sure of the answer, and students tended to want to talk out more, creating more classroom noise.

When asked what they did not like about the use of write-on response cards, the teachers questioned the expense and availability of the dry-erase markers and response boards for all of the students in their classes.

In summary, both teachers preferred the use of write-on response cards over single student responding because write-on response cards allowed more students to participate in the lessons.

**Limitations**

This study was limited by various uncontrolled environmental factors. These factors include student characteristics, teacher characteristics difficulty of material, setting/classroom ecology, time of school year, time of school day, and judging on/off-task behaviors.

**Student Characteristics**

One factor limiting this study was student characteristics. A total of 28 students participated in the whole class science instruction, with four students being selected by the principal, teachers, and experimenter as target students for additional observation of
appropriate classroom and on-task behaviors along with academic performance on daily quizzes. The classrooms were identified by the principal as having students who were disruptive and off-task, however, the principal indicated that by standardized test scores, no student in the entire school could be identified as at-risk for academic failure, although the target students were performing below classroom standards in some of their subject areas. The classrooms selected combined third and fourth grade students for whole class science instruction.

**Teacher Characteristics**

Students in both classrooms frequently combined for group lessons and were taught by both classroom teachers. In this study, however, the daily science lessons were not taught by the classroom teachers, but by the experimenter (who had a total of 10 years teaching experience). The experimenter conducted the lessons in order to keep them more conformed, as well as the experimenter having more expertise in the use of the procedures involved in the use of response cards than both regular classroom teachers. Results may differ with the regular classroom teacher teaching the daily lessons.

**Difficulty of the Material**

Daily science lessons covered areas of science indicated by the regular classroom teachers as areas not having been covered during the school year and were included in the school curriculum guide. The daily science lessons were developed by the experimenter combining a third and fourth grade level, possibly resulting in some areas being more difficult for some than others as measured by daily quizzes. Quiz items contained 7 recall items from fact/concepts presented in the daily lecture. Seven items was the number selected for the quiz in order that all students have time to finish the quiz in the required time constraints, being that some students in the classroom were multihandicapped students and some students were identified as having poor reading
skills. Keeping the quiz at seven items could have created a ceiling effect for some students, who consistently scored 6 or 7 out of a possible 7 items correct on the quizzes.

**Setting/classroom Ecology**

Daily science lessons occurred in one classroom of a double classroom separated by a sliding, dividing wall. All 28 participants were seated in one classroom at individual desks and at tables in groups of three to four. Results could be different if each individual students had their own individual desk with sufficient personal space. Target students were seated relatively near one or another for ease of observation purposes. Results may have differed if target students were spaced throughout the classroom.

**Time of School Year**

This study took place during the last two months of the school year. There was a period of one week in which data was not collected due to spring recess. The increase in outside temperature combined with the classroom air conditioner not working could have had an effect on student appropriate and on-task behaviors, as well as quiz performance. Conducting the study during the last few days of school could have had an effect on the results as well.

**Time of School Day**

Science instruction took place at a time selected before the beginning of the study by the classroom teachers and experimenter. This thirty-minute time slot fell between the last recess and going home for the day. Results may have been different if the class met at an earlier time in the morning, or in the afternoon. Due to a schedule conflict on Friday, the data was collected Monday through Thursday. Results may have differed if data was collected five days per week instead of four.

**Judging On/off-task Behaviors**

Although the definitions of the dependent variables were specifically defined and the observers were trained in the observation of on/off-task behaviors, judging exactly when
a student is on/off-task can be difficult. Subtle differences in individual observer judgment of on/off-task behaviors can and do occur, resulting in different behaviors being scored on the observation sheets.

**Task Difficulty**

During the observational recording procedures, the observers were required to distinguish between on-task and off-task behaviors as well as between appropriate and disruptive behaviors in a five second period for four target students. Observers were also required to listen to the lesson for teacher behavioral prompts so they could record the frequency of teacher behavioral prompts on the recording form. Because the observers had to pay close attention to the behavior of the target students, they could not always give full attention to the teacher behavioral prompts made during the lesson. This resulted in an IOA of the frequency of teacher behavioral prompts of 0%.

**Implications for the Classroom**

This study investigated the effects of single student responding and write-on response cards on the on-task and disruptive classroom behaviors as well as the academic performance of elementary students at-risk for academic failure during whole class science instruction. From the results, some implications can be made for the classroom.

The first implication for the classroom that can be made is that no functional relationship was demonstrated between the use of write-on response cards and higher academic performance for the students in this study. This may indicate that the use of single student responding or write-on response cards both promote student learning. Sixteen students made increased academic gains with the use of single student responding over the use of write-on response cards. Eleven students made increased academic gains with the use of write-on response cards over single student responding. One student showed no difference in academic gain between conditions. The number of quiz questions posed may influence the outcome, as a limit of 7 questions on each quiz may
have caused a ceiling effect. As this study was conducted with third and fourth grade students simultaneously, the difficulty of the material as well as the type of questions asked may be reviewed to assist students to be more successful on daily quizzes.

Research has demonstrated there is a functional relationship between the use of response cards and higher academic performance (Wheatley, 1986; Narayan, et al., 1990; Gardner, Heward & Grossi, 1994; Sweeney, et al., 1992; Cavanaugh, 1992).

A functional relationship was demonstrated between the use of write-on response cards and an increase in on-task behaviors, which was consistent with other findings (Gardner, et al., 1993). The use of write-on response cards gave all students more opportunities to respond and increase participation during the science lessons.

The use of scripted lessons kept the lessons consistent and the teacher more on-task during the presentation of the daily science lessons. It is possible that the teacher being more on-task may assist the students to be more on-task. The use of scripted lessons also requires more teacher preparation time than a simple lesson plan.

During single student responding, a random list of names was used to call upon individual students rather than having students raise their hands to answer questions. This was done to prevent the teacher calling on only those students whose hands were raised, and also so the students could not recognize when they may be called upon to answer a question. According to Heward (1994), if the presence or absence of controlling contingencies is obvious or predictable to the student, the student will recognize when there is no need to respond. The use of the random list during single student responding created unpredictability on the students' part to determine who would be called upon to answer teacher posed questions. This unpredictability may have contributed to increased on-task and appropriate classroom behaviors. Students were able to predict when they would be expected to answer teacher posed questions with the use of write-on response cards. This may imply that teachers using the unpredictable...
teaching techniques for students responding may see similar levels of appropriate classroom behavior as when using more predictable methods of student responding. The use of response cards (predictable) has more accountability than students' responding by raising their hands to answer questions. All students are expected to answer each question during the use of response cards, whereas with handraising, only those students raising their hands and the student actually being called upon is held accountable until the quiz.

**Direction of Future Research**

This study failed to reproduce the results in previous studies regarding the use of write-on response cards and the academic performance of students at-risk for academic failure (Wheatley, 1986; Narayan, et al., 1990; Gardner, Heward & Grossi, 1994; Sweeney, et al., 1992; Cavanaugh, 1992). It did, however, reproduce results from previous studies regarding write-on response cards and on-task behavior (Gardner, et al., 1993).

As a result of this study, a number of recommendations for the direction of future research can be made. First, the use of teaching technologies which are predictable for students as compared to the use of teaching technologies which are unpredictable for the students could be focused upon. This study found that using a predictable method for student responding (WORC) had relatively the same effect on students' disruptive classroom behavior and academic performance levels as did unpredictable student responding (SSR).

This study could be systematically replicated by using fewer students and/or a classroom with more appropriate student seating. Also, this study could be replicated using students of all the same grade level, not only at the elementary level, but at the middle school and high school level as well.
Other technologies that increase active student responding could be compared to the write-on response card condition. Rather than comparing a technology (WORC) that produces more student participation over single student responding (using a list or hand-raising), the comparison of two active student responding technologies could be compared to see the results on disruptive classroom and on-task behaviors.

In programming for generalized outcomes, this study could be replicated using the classroom teacher as the instructor rather than the experimenter, or alternating between the experimenter and classroom teacher. Response cards could be used not only for science, but other subjects as well. Students who spend time in more than one classroom could use response cards in various classrooms to see if on-task and appropriate behavior levels will generalize into other settings.

**Summary**

This study evaluated the differential effects of single student responding and write-on response cards on the on-task and disruptive classroom behaviors and the academic performance of elementary students at-risk for academic failure during whole group science instruction. A single student responding condition (SSR) consisting of the teacher using a premade, random list of names of all students in the classroom to call upon students to answer questions from the daily lesson was compared to a write-on response card condition (WROC) in which all students responded to teacher posed questions by writing their answers on individual response cards. This study was conducted to extend the current research base examining the effects of active student responding on the on-task/disruptive classroom behaviors and academic performance of students at-risk for academic failure.

Twenty-eight students participated in the academic performance portion of the study which was conducted in an inclusive elementary school classroom for third and fourth
grade students. Four students were targeted for additional data collection on their on-task and disruptive classroom behaviors.

Data for on-task and disruptive behavior as well as same-day quizzes were collected across 26 class sessions.

Results of the study indicate that a functional relationship was demonstrated between the use of write-on response cards and increase on-task behaviors for all four of the targeted students, similar to the findings in the literature (Gardner, et al., 1993). No significant functional relationship was demonstrated between the use of write-on response cards and the disruptive classroom behaviors of the target students or with the use of single student responding and disruptive classroom behavior. The fact that in both conditions response cards and single student responding each student needed to be prepared to respond to each teacher posed questions may have maintained appropriate student behavior across conditions. Also, there was no functional relationship demonstrated between the use of write-on response cards or single student responding and higher academic performance on daily quizzes.

Within the context of the current methods and procedures of this study, the results indicate that the use of write-on response cards may enhance the on-task behaviors of students at-risk for academic failure. This study also found that the classroom teacher may utilize indiscriminable contingencies (single student responding conditions) or active student responding techniques in their daily lessons (or a combination thereof), as there was no functional relationship demonstrated between lower percentages of disruptive classroom behaviors and the use of SSR or WROC, nor was there a functional relationship demonstrated between higher academic performance and the use of SSR or WROC conditions.

Twenty-five students participated in an exit interview regarding the use of single student responding and write-on response cards. Both students and teachers indicated a
preference for the use of write-on response cards over single student responding as their favorite way to answer questions. Most students felt that the use of write-on response cards helped them to understand the facts/concepts of the lessons better than single student responding, and slightly more than half of the students indicated they felt the use of write-on response cards helped them to get the best grade on the daily quizzes.
REFERENCES


Wallace, G., & Kauffman, J. M. (1986). Teaching students with learning and behavior problems, 3rd Ed., Columbus, OH: Charles E. Merrill


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APPENDIX A

LETTER OF CONSENT
WHAT IS WATER?
QUIZ

DIRECTIONS: Fill in the blanks with the correct answer to each question. Remember to use your cover sheet to cover your answers as you finish each one.

1. ______________________ is the chemical name for water.

2. What are the two different types of atoms found in water? _____________________ and _____________________.

3. What is the boiling point of water? ________________ degrees Fahrenheit.

4. What is the freezing point of water? ________________ degrees Fahrenheit.

5. The earth's surface is covered by ________________ % water.

6. Only ________________ % of the fresh water can be used for our daily needs.
APPENDIX C

SAMPLE DAILY QUIZ ANSWER KEY
WHAT IS WATER?
ANSWER KEY

1. ________________ is the chemical name for water. (H2O)

2. What are the two different types of atoms found in water? _____________ and _______________. (HYDROGEN and OXYGEN—any order)

3. What is the boiling point of water? ________________ degrees Fahrenheit. (212)

4. What is the freezing point of water? ________________ degrees Fahrenheit. (32)

5. The earth's surface is covered by _____________% water. (75)

6. Only ________________% of the fresh water can be used for our daily needs. (1%)
APPENDIX D

SAMPLE OBSERVATION RECORDING FORM
**OBSERVATIONAL RECORDING FORM**

On-Task/Off-Task and Appropriate/Disruptive Classroom Behaviors

<table>
<thead>
<tr>
<th>Interval #</th>
<th>Student 1</th>
<th>Student 2</th>
<th>Student 3</th>
<th>Student 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ON APP TB</td>
<td>ON APP TB</td>
<td>ON APP TB</td>
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</table>

If one or more of the following behaviors occur at any time during the interval, mark a slash (/) through the behavior:

- **OFF-TASK**: Eyes directed away from teacher or student answering teacher-question, completing other work not related to the lesson being taught, gazing out of the window during lesson.
- **DISRUPTIVE**: Talking out loud during lesson w/o permission, pounding on desk with hands/pencil, etc., making noises out loud, touching/poking classmates, out of seat.
APPENDIX E

SAMPLE DATA SUMMARY SHEET

178
<table>
<thead>
<tr>
<th>STUDENT</th>
<th>QUIZ SCORE</th>
<th>ON-TASK INTERVAL #</th>
<th>ON-TASK %</th>
<th>DISRUPTIVE BEHAVIOR INTERVAL #</th>
<th>DISRUPTIVE BEHAVIOR %</th>
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</tbody>
</table>

NAME: __________________________ DATE: __________________________

CONDITION: __________________________
APPENDIX F

SAMPLE LECTURE OUTLINE
What is Water?
Lesson 1

Water is something we see probably every day. We drink it, we bathe in it, we use it to water
plants. It is something very common to us, yet how much do you really know about water?

1. Water is made of two different types of atoms: hydrogen and oxygen. The chemical name for
water is H2O. This means in every water molecule there are two atoms of hydrogen and one of
oxygen. There are billions of water molecules in a single drop of water. QUESTION: 1. What
is the chemical name for water? _______________ (H2O) (Use List 2) QUESTION: 2.
What are the two different types of atoms found in water? ___________ and ____________
(HYDROGEN and OXYGEN) (Use List 2).

2. Water has three different forms: a solid, (ice), a liquid, (water) and a gas (steam/water vapor).
Water can turn from a solid (ice) into a liquid by letting it stand at room temperature. We can
then turn the liquid into a gas (steam) by bringing it to a boiling. The boiling point of water is
212 degrees F. We can turn liquid water into a solid (ice) by freezing it. The freezing point
of water is 32 degrees F. QUESTION: 3. The boiling point of water is ________________
degrees Fahrenheit. (212) (Use List 2) 4. The freezing point of water is ________________
degrees Fahrenheit. (32) (Use List 2).

programmed behavioral prompt #1

3. Water is found everywhere. It covers 75% of the surface of the earth. All living things need
water. 97% of that water is salt water, which we cannot drink. Only 3% of the remaining water
is fresh water, which we can drink, but 3/4 of that 3% we can drink is frozen in ice caps at the
north and south poles. That means less than 1% of all the water on earth can be used for our daily
needs. QUESTION: 5. Water covers how much of the earth's surface? ____________%
(75) (Use List 2) QUESTION: 6. How much of all of the water on earth can be used for our
daily needs? ___________% (1%) (Use List 2)

programmed behavioral prompt #2

REVIEW:
1. What is the chemical name for water? _______________ (H2O)
2. What are the two different types of atoms found in water? _______________ and
_______________. (HYDROGEN and OXYGEN)
3. The boiling point of water is ________________ degrees Fahrenheit. (212)
4. The freezing point of water is _______________ degrees Fahrenheit. (32)
5. Water covers how much of the earth's surface? ________________% (75)
6. How much of all of the water on earth can be used for our daily needs?
______________%. (1%)

programmed behavioral prompt #3

EXPERIMENT: demonstration of how much water is available to use for our daily needs
QUIZ
APPENDIX G

SAMPLE STUDENT PREFERENCE INTERVIEW FORM
STUDENT INTERVIEW FORM

Student: ___________________________ Date: ____________________

Interviewer: ________________________________________________________

(read to students)

"I am going to ask you a few questions regarding the science lessons you learned about during the last few weeks. Your last name will not be written down so people will not know who you are. I will write down what you say to each question and then read it back to you to see if I wrote it down correctly. If I write something down differently than what you mean to say, I will change it and read it again. There are no right or wrong answers to the questions I will ask you. This is not a test. In other words, your answer here will not affect your grade in science. Do you have any questions before we begin?"

1. What was your favorite way to answer questions?

   ______ Hand-raising   ______ Response Card

2. Which way of answering did you feel helped you the most?

   ______ Hand-raising   ______ Response Card

3. Which way of answering the questions helped you get the best grade?

   ______ Hand-raising   ______ Response Card

4. What are the things you liked about hand-raising?

5. What are the things you didn't like about hand-raising?

6. What did you like about using response cards?

7. What didn't you like about using response cards?

8. Do you have anything else you would like to say or ask about the way you were instructed in science?
APPENDIX H

TEACHER PREFERENCE FORM
TEACHER PREFERENCE FORM

Teacher: _______________________________ Date: __________________

Interviewer: ______________________________________________________

1. What did you perceive to be the students' favorite way to answer questions?
   _____ Hand-raising    _____ Response Card

2. Which way of answering did you feel helped the students the most?
   _____ Hand-raising    _____ Response Card

3. Which way of answering the questions helped the students get the best grade?
   _____ Hand-raising    _____ Response Card

4. What are the things you liked about hand-raising?

5. What are the things you didn't like about hand-raising?

6. What did you like about using response cards?

7. What didn't you like about using response cards?

8. During which response mode (hand-raising or response cards) did you notice the least amount of disruptive/off-task behavior and why?
APPENDIX I

PROCEDURAL INTEGRITY OBSERVATION SHEET
<table>
<thead>
<tr>
<th>Condition: (Check One)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Student Response</td>
<td></td>
<td>Write On Response Cards</td>
<td></td>
</tr>
<tr>
<td>Are daily quizzes returned to students by the next day?</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>Are overhead transparencies used for facts/concepts of each daily lesson?</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>For Single Student Response Condition, is a name list used to call upon students for answers?</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>For Response Card Condition: does each student have their own response card and marker?</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>Does the teacher wait 3 seconds before asking for a student response to a question?</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>Is a quiz given following the daily lesson?</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>Does the teacher use a scripted lesson for each daily lesson?</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>Does the teacher give a MINIMUM of three behavioral prompts during the lesson?</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
</tbody>
</table>

Observer's Name: _____________________________

Date: _____________________________
**BEHAVIOR CLASSIFICATION**

**Directions:** Check the classification of the behavior identified in the "Behavior" column (Either on-task or off-task AND either appropriate or disruptive).

<table>
<thead>
<tr>
<th>BEHAVIOR</th>
<th>ON-TASK</th>
<th>OFF-TASK</th>
<th>APPROPRIATE</th>
<th>DISRUPTIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Looking at the teacher during the lesson.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Looking at a peer who is not responding to a question during the lesson.</td>
<td></td>
<td>X</td>
<td>X</td>
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<tr>
<td>3. Turned around in her/his seat during the lesson.</td>
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<td>X</td>
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<td>X</td>
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<tr>
<td>4. Head on hands, looking at teacher or peer answering a question.</td>
<td></td>
<td>X</td>
<td>X</td>
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<tr>
<td>5. Quietly writing on paper or response card that is not part of the lesson.</td>
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<td>X</td>
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<tr>
<td>6. Talking to a peer without teacher direction.</td>
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<td>X</td>
<td>X</td>
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<tr>
<td>7. Writing the answer to a question but saying the answer aloud.</td>
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<td>X</td>
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<tr>
<td>8. Making noises during the lesson.</td>
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<td>X</td>
<td>X</td>
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<tr>
<td>9. Slouching in her/his seat during the lesson when listening to or responding to a teacher-directed question.</td>
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<td>X</td>
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<tr>
<td>10. Commenting on getting a question correct immediately after question is asked.</td>
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<td>X</td>
<td>X</td>
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</tbody>
</table>
APPENDIX K

CLASSROOM EXPECTATIONS
CLASSROOM EXPECTATIONS

The following expectations, already in place and expected in the classroom, will be followed during classroom instruction:

1. Stay in your seat.
2. Keep your hands and feet to yourself.
3. Ask permission before talking out.
4. Follow directions
5. Be helpful to each other.

During classroom instruction, the teacher will first use positive behavioral statements to redirect any inappropriate/disruptive behaviors displayed by students before identifying a specific student with a specific behavior change.