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Andrew Bruce, John Wills Lloyd, Michael J. Kennedy

TARGETS OF SELF-MONITORING: PRODUCTIVITY, ACCURACY, AND ATTENTION

Andrew Bruce, John Wills Lloyd
and Michael J. Kennedy

ABSTRACT

Self-monitoring has become one of the most widely employed self-control procedures in special education for students with learning disabilities and emotional or behavioral disorders. Although its success has been documented across age groups, settings, and diverse applications, researchers have continued to study the question of whether focusing self-monitoring on certain target behaviors – particularly attention to task or academic performance – will yield superior outcomes for students. We review 11 available studies that have examined this issue, classifying each study according to the ways in which the researchers had students monitor their own behavior. The results show only small differences among the different methods and indicate a need for teachers to continue exercising professional judgment in planning the use of self-monitoring.

People may behave differently simply because they know they are being observed, are being assessed, or are participating in a research project

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(Haynes & Horn, 1982; Kazdin, 2010; Webb, 1966). Reactivity to assessment makes it difficult for scientists to extrapolate from experimental situations, where behavior was observed, to the natural situations, where behavior usually happens without obvious observation. Reactivity limits external validity in most research, making it difficult to generalize results from the contrived experimental situation to the normal, everyday situation. Pioneers in self-monitoring, however, stood reactivity on its head by using reactivity to assessment as a means of treatment (e.g., Johnson & White, 1970; Kanfer, 1970, 1975). If having people monitor their own behavior caused the behavior to change, so be it! When clinicians asked smokers to count cigarettes smoked or puffs puffed, smokers smoked or puffed less often, and when they asked people to count spoons-full consumed, people ate less (Mahoney, Moura, & Wade, 1973; McFall, 1970; McFall & Hammen, 1971; Romanczyk, Racey, Wilson, & Thorpe, 1973). Since the 1970s, research on self-recording or self-monitoring of behavior has increased dramatically.

Those early reports from clinical psychologists included some applications with children. For example, Maletzky (1974) tested self-monitoring with children such as "a 9-year-old boy [who] raised his hand repeatedly in class, waving it furiously in response to his teacher's questions, despite not know the answers on many such occasions" (p. 109) and "an 11-year-old girl [who] was noted to be constantly out of her seat in class" (p. 110). Other researchers in the 1970s correctly hypothesized that interventions including self-recording and self-monitoring might also influence outcomes for students with disabilities. This research proliferated across the years and continues today (Lloyd & Landrum, 1990; Maag, 1998; Mooney, Ryan, Uhing, Reid, & Epstein, 2005; Reid, 1996; State & Kern, 2012). Whereas only a few studies examined the effects of self-monitoring with children with disabilities before 1980, a quick search of databases in 2012 revealed almost 1,000 references. In summary, clinical applications of self-recording or self-monitoring are commonplace in special and general education. Furthermore, efforts to teach students to record their own behavior – with varying degrees of detailed and precise training – occur every day in schools around the world.

The extensive research, beginning in the 1970s (e.g., Broden, Hall, & Mitts, 1971; Gottman & McFall, 1972; Hallahan, Lloyd, Kosiewicz, Kauffman, & Graves, 1979; Lovitt, 1973) and continuing in the 2000s (e.g., Legge, DeBar, & Alber-Morgan, 2010; Rafferty & Raimondi, 2009; Rock, 2005) resolved many important questions, but left others unanswered. In this laconic review, we provide background about self-monitoring, review

some of those key findings, and focus on one of the important unresolved issues: What is the appropriate target for students to record when they monitor their own behavior?

SELF-MONITORING AS A COMPONENT OF OR A COMPLETE TREATMENT

Self-monitoring is one of several self-control or cognitive-behavior treatment methods that gained popularity among researchers and practitioners during the 1970s and 1980s. Other interventions include self-instruction, self-reinforcement, goal-setting, and combinations of each (Kurtz & Neisworth, 1976; Lovitt, 1973; Meichenbaum, 1977). Some researchers add others (e.g., self-evaluation) to this list or distinguish among them in a more fine-grained manner (self-assessment versus self-recording or self-monitoring) for theoretical reasons or for the purposes of making explicit comparisons among components (e.g., Hallahan, Lloyd, Kneedler, & Marshall, 1982).

Educators may employ self-monitoring as a stand-alone intervention or as a component of other more comprehensive interventions. Self-monitoring is used as a stand-alone intervention when the targeted behavior is the ultimate goal of the intervention. That is, the reactivity effects of self-monitoring can be utilized as the sole means of behavioral change. Alternatively, self-monitoring can be used as part of a package in order to increase implementation of a treatment component, or when the desired behavior is more complex in nature (e.g., constructing a paragraph).

Self-Monitoring as an Intervention

Though self-monitoring has been conceptualized and implemented in different ways, there are certain characteristics common to all self-monitoring procedures. No matter the target of self-monitoring, students need to be trained to implement the procedure with accuracy and consistency. Training must also provide clear examples and nonexamples of the targeted behavior. The student must be fluent when making assessments of behavior to minimize interference with their academic work or misperceptions about their actual behavior.

After training, students implement the self-monitoring technique in their classroom. The first step in implementation is for the student to assess

whether the targeted behavior has occurred. This can be done in an intermittent or summative manner. In intermittent assessment, the students are prompted through an audible tone or by a mark on a worksheet to stop and compare their behavior to the targeted behavior (e.g., on-task, accuracy of work). In summative assessment, the student works on a task for a specified amount of time and only assesses his or her behavior at the end.

After assessing behavior, the student is required to record his or her assessment. How this recording is done is dependent upon the targeted behavior. Most versions of self-monitoring require the student to have a premade sheet of paper where he or she can systematically record behavior occurrences. If monitoring attention, the student would check yes if he or she were paying attention, or no if not paying attention when the tone sounded. If monitoring performance, a yes or no procedure no longer makes sense. Instead, a student monitoring productivity would record the number of problems completed or words written in the allotted time. If the student were monitoring accuracy, he or she would write a ratio of problems completed, or words written accurately, over the total number of problems or words attempted.

All studies included in this chapter tested the effects of self-monitoring procedures during academic seat work (i.e., math problems, spelling words, story writing), and not during other classroom activities. This focus makes sense as academic seat work provides an easily measured dependent variable against which different self-monitoring methods can be tested. Though self-monitoring of performance (SMP) does not lend itself to use outside of academic seat work (there is no work to monitor during instruction), there is no reason that self-monitoring of attention (SMA) cannot be used through an entire class period.

Components Analyses

Researchers have conducted extensive analyses of the components of self-monitoring. Heins, Lloyd, and Hallahan (1986) found that boys' levels of attending was higher under cued than noncued self-monitoring conditions, indicating that the cues for self-recording were important in producing higher levels of reactivity. Hallahan et al. (1982) demonstrated that when a student monitored his own behavior, his levels of on-task behavior were higher than when his teacher judged whether he was attending and then recorded his teacher's decision. So the "self" is important in self-monitoring. Further research demonstrates that the recording component

of self-monitoring leads to gains in on-task behavior over self-assessment alone (Lloyd, Hallahan, Kosiewicz, & Kneedler, 1982).

Self-monitoring has been applied in diverse settings and across age groups. Participants have been as young as 4 years of age (Workman, Helton, & Watson, 1982) and as old as adolescents (e.g., Hughes et al., 2002) and adults (Rudrud, Ziarnik, & Colman, 1984). Not only have the procedures been used in schools (e.g., McLaughlin, 1984), but they have also been in children's homes (e.g., Axelrod, Zhe, Haugen, & Klein, 2009) and in juvenile justice facilities (Young, Birnbrauer, & Sanson-Fisher, 1977) and athletic venues (e.g., Critchfield & Vargas, 1991).

Self-monitoring has proven effective at increasing achievement (Sagotsky, Patterson, & Lepper, 1978), on-task behavior (Marshall, Lloyd, & Hallahan, 1993; Thomas, 1976), class participation (Gottman & McFall, 1972), productivity (Harris, 1986; Wolfe, Heron, & Goddard, 2000), and academic accuracy (Maag, Reid, & DiGangi, 1993; Roberts & Nelson 1981) as well as other behaviors (see Joseph & Eveleigh, 2011; Shapiro & Cole, 1999). Furthermore, self-monitoring has been shown to be an effective intervention for students with learning disabilities (LD; Lloyd et al., 1982; Reid & Harris, 1993), emotional and behavioral disorders (EBD; McLaughlin, Krappman, & Welsh, 1985), attention deficit hyperactivity disorders (ADHD; Christie, Hiss, & Lozanoff, 1984; Harris, Friedlander, Saddler, Frizzelle, & Graham, 2005), intellectual disabilities (ID; Morrow, Burke, & Buell, 1985), and for students with no identified disability (Sagotsky et al., 1978; Thomas, 1976). In sum, self-monitoring has been shown to be a robust and effective stand-alone intervention.

Self-Monitoring as Component

Sometimes, however, self-monitoring is used not as an intervention by itself but as a feature in a more comprehensive intervention. Probably the most widely known example of this use of self-monitoring is its use in Self-Regulated Strategy Development (SRSD; Harris & Graham, 1999). As Harris and Graham detail, their full model of SRSD incorporates strategy instruction with self-monitoring (and goal-setting) in the Discuss It, Model It, Memorize It, Support It, and Independent Performance components of the model. Similarly, Montague's (2003) *Solve It* mathematics program adopts a cognitive strategy approach that includes a self-monitoring step in which students check their work at many of the stages of the strategy.

In contrast to interventions where self-monitoring stands alone as an intervention, in the cases of *Solve It* and SRSD, the purpose of self-monitoring is not to increase or decrease a specific behavior but to increase implementation of the targeted strategies. Even though self-monitoring is not the primary intervention, a meta-analysis of strategy instruction studies identified self-monitoring as one of the three most powerful elements of strategy instruction in SRSD (De la Paz, 2007). Self-monitoring is an effective means of increasing implementation of a targeted behavior, and as such it has the potential to be incorporated into a wide array of comprehensive interventions.

Summary

From these brief examinations of the research on self-monitoring, it is clear that the procedure has been applied across a wide range of general conditions. Not only do we know that it has worked with students who differ in many ways (age, gender, disability, and so forth) and that certain of its components are important for its success, but we also know that self-monitoring can be applied to different target behaviors. That is, students can be taught to monitor attention to task, various forms of behavior, academic performance, and many other actions. This last matter, the targets of self-monitoring, is the primary focus of our analysis for the remainder of this chapter.

COMPARISONS OF TARGETS FOR SELF-MONITORING

The relative benefits of SMA and SMP have been discussed repeatedly by scholars interested in this area of research (e.g., Snider, 1987) as well as the authors of experiments to which we shall turn in the subsequent section of this chapter. In this section, we will discuss the theoretical assumptions underlying SMA and SMP before turning our attention to the different methods for assessing and recording SMP.

Before we examine the relative benefits of SMA and SMP, it is necessary to define what behaviors these interventions seek to change. The three main behavior targets that emerge from the literature examined for this study are on-task behavior, academic productivity, and academic accuracy. SMA and SMP both attempt to affect behavioral change in these three

dependent variables, but they do so operating under different theoretical assumptions.

Examination of these theoretical assumptions will help frame the questions we seek to answer through the rest of the chapter. First, is attention a prerequisite to academic production? In other words, are the academic benefits observed from teaching moderated by whether or not the student was paying attention? Second, does academic production first require attention, or can a student's production increase while attention remains level? Third, is accuracy dependent upon increases in attention, or is some other factor concurrently affecting both variables? Fourth, does targeting one behavioral outcome necessarily lead to improvements in other behavioral outcomes? Would increased accuracy, for example, mean that there was also increased on-task behavior and productivity? Lastly, is attention just an ancillary benefit to self-monitoring procedures? Maybe attention is such a popular behavioral target because of its social validity. Teachers, parents, and others consider attention to be important but is it logically and scientifically less important than productivity?

We examined the research about alternative targets for self-monitoring to ascertain whether it provided a consensus about which specific target was the most appropriate for practice or whether conditional statements based on subject characteristics, methods, or other factors could be made.

METHODS

In our literature search, we entered the terms "self-monitoring," and "attention or performance," and, when possible, restricted the search results to the field of education. We searched the Academic Search Complete, PsycINFO, Web of Science, and Google Scholar databases for relevant articles. We read the abstracts for all articles that mentioned self-monitoring of attention, or self-monitoring of performance and included all articles that directly tested the differential effects of self-monitoring of attention versus some form of self-monitoring of performance. Next, we reviewed the reference lists for the included articles using the same criterion (i.e., the article must report an actual study examining the differential effects of self-monitoring of attention and self-monitoring of performance). Finally, we used the Google Scholar database to examine the studies that had cited our already included works to determine if any newer research had been missed. A total of 11 articles covering 13 comparisons between SMA and a form of SMP met our criterion and were included in our review.

From each study, we extracted basic descriptive data (e.g., students' characteristics, settings). We also classified the procedures according to the different ways in which the self-monitoring methods were defined and implemented. Virtually no difference was found in the way in which self-monitoring of attention was implemented across the studies; with the exception of Roberts and Nelson (1981), and Rafferty and Raimondi (2009), all of the studies employed essentially the same procedure for self-monitoring of attention. Rafferty and Raimondi stated they were following the same procedures as Hallahan et al. (1979), which many of the articles cite as a guide, but they used a 5-minute fixed interval for their cues rather than the 45-second average (range 10–90 seconds) interval tones employed by Hallahan et al. Most studies reported interobserver agreement, had clear definitions of the dependent variables, described observer training procedures, and reported the accuracy of student self-monitoring. Because there was such little variation in these study characteristics, we did not include them in our analysis.

Although SMA was implemented in a relatively uniform manner, SMP differed across studies in two ways. The first distinction was whether SMP focused on productivity or accuracy. Some early studies focused simply on productivity (e.g., Harris, 1986; Lloyd, Bateman, Landrum, & Hallahan, 1989), but more recent studies focused on the number of items completed correctly (e.g., Harris, Graham, Reid, McElroy, & Hamby, 1994; Rafferty & Raimondi, 2009; Selznick & Savage, 2000). The second distinction among the procedures for self-monitoring of performance was the method in which the recording took place. As can be seen in Table 1, in five of the studies, students were intermittently prompted with a tone to assess and record their progress. The remaining eight studies (see Table 1) eschewed the use of prerecorded tones and had the students assess their performance in a summative assessment.

These two distinctions created four different methods of self-monitoring of performance as shown in Table 2. There could be further theoretical distinctions made (e.g., the difference between accuracy and fluency, recording total correct versus percent correct), but there have not yet been enough studies to make those fine distinctions in a review of the literature.

We classified the methods of self-recording performance as follows:

1. *Summary production*: In the method we are calling "summary production," the researchers had the students record the number of items they had completed at the end of a given time period. This is a summative recording; it is only done once during a session. The earliest exemplar of

Table 1. Relative Effects of Self-Monitoring Procedures.

Method	Studies Using the Method	Results Compared to Self-Monitoring of Attention		
		On-task outcomes	Production outcomes	Accuracy outcomes
Summary production: At the end of time period, students record the number of items completed.	Harris (1986)	SMA = SMP	SMA = SMP	NA
	Harris et al. (1994), experiment 2	SMA = SMP	SMA = SMP	NA
Summary accuracy: At the end of time period, students record the number of items completed correctly.	Harris et al. (2005)	SMA = SMP	NA	SMA > SMP
	Harris et al. (1994), experiment 1	SMA = SMP	NA	SMP > SMA[a]
	Rafferty and Raimondi (2009)	SMA = SMP	SMP > SMA	SMP > SMA
	Reid and Harris (1993)	SMA = SMP	SMP > control	SSP > SSA
Intermittent production: At irregular intervals, students record the number of items completed since the previous monitoring action.	Lloyd et al. (1989)	SMA = SMP	NA	SMA > SMP[b]
	Lam, Cole, Shapiro, and Bambara (1994)	SMP = SMA	NA	SMP > SMA
	Maag et al. (1993)	SMA = SMP	SMP > SMA	SMA = SMP[c]
Intermittent accuracy: At irregular intervals, students compare their answers to those on an answer sheet and record whether their answers are correct.	Rooney, Polloway, and Hallahan (1985)	SMA = SMP	SMA = SMP	SMA = SMP
	Roberts and Nelson (1981)	SMA = SMP	SMA = SMP	SMA = SMP
	Maag et al. (1993)	SMA = SMP	SMA = SMP	SMA = SMP[c]
	Selznick and Savage (2000)	SMA = SMP	SMA = SMP	SMA = SMP

[a]We decided the results favored SMP although our decision was based on differences observed in the choice condition of one of the participants. Some might interpret the results differently due to order of effects.
[b]Although three of the five participants favored SMA, one of the participants was close to the criteria for favoring SMP.
[c]Different effects between 4th- and 6th-grade participants confounded results based upon our criterion. Monitoring productivity increased three out of four 4th-grade students' accuracy, while both 6th-grade students completed assignments with higher accuracy while monitoring accuracy.

Table 2. Four Methods for Self-Monitoring Performance.

	Intermittent	Summative
Production	Students monitor their performance repeatedly during a period of time.	Students assess their performance at the end of a period of time.
Accuracy	Students monitor the accuracy of their work repeatedly during a period of time.	Students assess the accuracy of their work at the end of a period of time.

this method was employed by Harris, who reported that the teacher in her study met with the student, explained the idea of self-monitoring spelling practice and then, "the student was instructed to count the number of times his or her spelling words had been written at the end of the period, and then to record this number on a graph in his or her spelling file" (1986, p. 419).

2. *Summary accuracy*: In summary accuracy, students assess and record how well they had done on their work at the end of a time period. Generally, a student is given an answer sheet and asked to correct his or her work before reporting only those items that were done correctly. For example, Rafferty and Raimondi (2009) used summary accuracy during a math activity. They gave each student a folder with an answer sheet, and at the end of the activity the students graded their work and graphed how many problems they had completed correctly.
3. *Intermittent production*: In intermittent production the student records how much she or he has completed periodically throughout the session. Rather than occurring only once, the student makes multiple observations about productivity. In this way, the procedure is more similar to the attention-to-task procedure. Lloyd et al. described one such procedure, saying that "at the time of the tone, the students were taught to ask themselves how much work they had completed. To make this judgment, at the tone they marked the problem on which they were working, counted how many problems they had completed since the previous cue, and recorded this number on prepared recording sheets" (1989, p. 318).
4. *Intermittent accuracy*: In the method we call "intermittent accuracy," students compare the accuracy of their work to a standard (e.g., an answer sheet) and record whether their answer was correct. For example, while working on arithmetic practice pages in the study by Rooney et al. (1985), when a student came to a problem with a letter next to it, he or

she was instructed to uncover the correct answer and was then to indicate the accuracy of his work on a Yes/No recording sheet. Maag et al. (1993) used a different procedure, but it still essentially required the students to stop periodically and compare their answers to a standard. Procedures may vary depending on whether students are required to correct errors (immediately, later, or at all).

Once we sorted the studies into these four categories, we coded the population of students each study examined, the disabilities of the participants in each study, where the intervention took place, and the subject area on which the self-monitoring procedure was focused.

We also coded each study's dependent variable, classifying the variables according to whether each assessed *attention*, *productivity*, or *accuracy*. Every study included on-task behavior, which was reported as percent of time-on-task, and we classified these as measures of *attention*. Although some studies' definitions of on-task behavior were slightly different from each other, overall the definitions were similar. When a study reported the number of items completed as a dependent variable, we identified this as a measure of *productivity*. Researchers measured either the number of math problems completed or the number of words written in spelling or composition. Productivity was used as a dependent variable in nine of the studies we examined for this chapter. The productivity condition had no measure for the accuracy of those problems or words. However, when researchers assessed items or units of work completed correctly, we classified their dependent variables as measures of accuracy. Research assessed accuracy in three different ways across the studies we examined. Harris (1986), Harris et al. (2005), and Rafferty and Raimondi (2009) reported the number of problems completed or words written correctly in their studies. Lloyd et al. (1989) reported accuracy as the number of correct movements a student displayed per minute, introducing an element of fluency into the accuracy measure. Last, Maag et al. (1993) conceptualized accuracy as the percentage of problems a student completed correctly. We grouped these three different interpretations of accuracy together because of the limited number of studies implementing the rate and percentage forms of accuracy measures.

Finally, we analyzed the graphs and results sections of each study to determine if the study showed whether any procedure produced improvement in each different outcome area. Reid and Harris (1993) reported the only group-contrast study included in this review. We simply adopted their analysis of that study's results based on the significance of their statistical

analysis. For the single-subject studies in this corpus to be judged as lending support to a self-monitoring procedure, we adopted the following criteria. First, the data for more than half of the participants in a study had to demonstrate effects favoring the same treatment condition. Second, intervals in multiple baseline procedures must show a level change, and show a sustained change in slope (i.e., each phase needs multiple data points indicating a trend). Third, when interpreting results from an alternating treatment (multielement) design, element A was considered more effective than element B if there was separation such that one condition consistently resulted in higher levels of performance than the other (i.e., at least 80% of the data points were higher than their counterparts in a phase).

This last matter is the key question. Does SMA produce improvements in attention, but only in attention outcomes while SMP produces improvements in attention as well as performance? Or, does SMP produce improvements in performance and only in performance? How about SMP when accuracy is the target? What does it improve? There are important possible comparisons that need to be made and the farther researchers go with these examinations, the more detailed these comparisons become.

RESULTS AND DISCUSSION

Given that there are only 11 studies and 1 of them used a group-contrast design (Reid & Harris, 1993), we are drawing from a limited database and can only make preliminary inferences about the questions at hand. In total, the 11 studies reported 13 direct comparisons between SMA and SMP. Harris et al. (1994) conducted two experiments, and Maag et al. (1993) compared two different forms of SMP to SMA. The 13 studies reported results for different subject areas: 8 for math (Lam et al., 1994; Lloyd et al., 1989; Maag et al., 1993, comparisons 1 and 2; Rafferty & Raimondi, 2009; Roberts & Nelson, 1981; Rooney et al., 1985; Selznick & Savage, 2000), 4 for spelling (Harris, 1986; Harris et al., 1994, study 1; Harris et al., 2005; Reid & Harris, 1993), and 1 for story composition (Harris et al., 1994, experiment 2). Participating students' ages ranged from 8 to 14 years. Although there were more studies of students with LD than any other category, there were too few of any other category (e.g., ADHD) to permit us to make comparisons by category.

Table 1 presents the main results of our review, and it shows that the data are quite mixed. Although the data do not show that focusing self-monitoring on attention or productivity (either accuracy or quantity) yields

consistently superior results, we can draw some broad conclusions from these studies. We describe the effects of SMA and SMP individually before comparing the two self-monitoring procedures.

Self-monitoring of attention proved to be an effective means of increasing student time-on-task, productivity, and accuracy. SMA increased student on-task rates over baseline in every study examined in this review. Productivity was measured as a dependent variable in 9 of the 13 studies we examined. SMA led to increased productivity in seven (Harris, 1986; Harris et al., 1994, experiment 2; Maag et al., 1993; Rafferty & Raimondi, 2009; Reid & Harris, 1993; Rooney et al., 1985) of the nine studies. Roberts and Nelson (1981) and Selznick and Savage (2000) reported high levels of variability across all conditions that masked any treatment effect that may have occurred. Eleven studies included measures of academic accuracy. Of those 11 studies, 8 (Harris et al., 1994, experiment 1; Harris et al., 2005; Lam et al., 1994; Lloyd et al., 1989; Maag et al., 1993, comparisons 1 and 2; Rafferty & Raimondi, 2009; Rooney et al., 1985) showed SMA improving accuracy over the baseline condition. Variability, again, led to the lack of a treatment effect for two studies (Roberts & Nelson, 1981; Selznick & Savage, 2000), but Reid and Harris (1993) found that spelling accuracy decreased in the SMA condition, though the difference was not significantly below the control group.

Similarly, the evidence is strong that SMP procedures increase attention, productivity, and accuracy over baseline conditions. SMP led to higher rates of on-task behavior in all 13 reported studies. As with SMA, seven (Harris, 1986; Harris et al., 1994, experiment 2; Maag et al., 1993; Rafferty & Raimondi, 2009; Reid & Harris, 1993; Rooney et al., 1985) of the nine studies examining productivity reported that SMP resulted in observed levels higher than the baseline condition. Again, the same two studies (Roberts & Nelson, 1981; Selznick & Savage, 2000) did not allow us to draw conclusions about SMP's effects on productivity or accuracy. In 8 (Harris et al., 1994, experiment 1; Harris et al., 2005; Lam et al., 1994; Lloyd et al., 1989; Maag et al., 1993, comparisons 1 and 2; Rafferty & Raimondi, 2009; Rooney et al., 1985) of the 11 studies that reported accuracy data, students showed significant increases over baseline. In the one group-contrast study, Reid and Harris (1993) found that SMP produced higher levels of accuracy than the control condition, though the difference was not significant.

Overall these data support 30-plus years of self-monitoring research. Both SMA and SMP are effective methods to increase student on-task behavior. The data also show that student productivity and student accuracy are increased by both SMA and SMP. But did either of these methods

distinguish themselves from the other? We compared SMA to SMP as a whole before comparing each of the four SMP subcategories (i.e., Intermittent Production, Intermittent Accuracy, Summative Production, and Summative Accuracy) to SMA.

Although we examined 11 published studies and 13 individual comparisons of the effects of SMA versus SMP, we are left with no clear best procedure. No study reported a difference in the level of on-task behavior under the SMA or SMP treatment condition. Of the nine studies reporting productivity as a dependent variable, two favor SMP over SMA (Maag et al., 1993; Rafferty & Raimondi, 2009); one of those two (Rafferty & Raimondi) used a longer time interval for the SMA condition (5 minutes) than other studies in the corpus. The only group-contrast study, Reid and Harris (1993), found students' on-task behavior was significantly higher under SMP than the control condition and SMA was not, but there was not a significant difference between SMP and SMA.

There were 11 comparisons between SMP and SMA on the accuracy of student responses. Of these, two favor SMA (Harris et al., 2005; Lloyd et al., 1989), four favor SMP (Harris et al., 1994, experiment 1; Lam et al., 1994; Rafferty & Raimondi, 2009; Reid & Harris, 1993), and five show no difference between treatment conditions (Maag et al., 1993, comparisons 1 and 2; Roberts & Nelson, 1981; Rooney et al., 1985; Selznick & Savage, 2000). Due to the limited number of studies and the conflicting results, we cannot make an overall judgment on the effects of SMP procedures versus SMA on the accuracy of students' performance.

According to our classification procedures only two studies employed Summary Production as the target of self-monitoring (Harris, 1986; Harris et al., 1994, experiment 2). In both studies, students counted the number of words that they had written during the allotted time for an activity (i.e., spelling and story writing). Neither of these studies showed effects favoring one condition over another.

Four studies used our Summary Accuracy method (Harris et al., 1994, experiment 1; Harris et al., 2005; Rafferty & Raimondi, 2009; Reid & Harris, 1993). The Summary Accuracy group provided the most divided results of the four categories. Three of these studies favored SMP procedures over SMA, but the fourth (Harris et al., 2005) favored SMA over SMP. Upon examination, students in the three studies favoring SMP had been diagnosed with LD (two studies) and EBD (one study) and students in the study favoring SMA were diagnosed with ADHD (Harris et al., 2005). Harris speculated that "There may be somewhat of an aptitude-by-treatment response with these two groups, as students with ADHD

tended to do better on academic responding in the SMA condition whereas students with LD tended to do better in the SMP condition" (p. 154).

Three studies utilized Intermittent Production as a target variable (Lam et al., 1994; Lloyd et al., 1989; Maag et al., 1993, comparison 1). Of the three, only Maag et al. assessed productivity without an element of accuracy. They found that students utilizing SMP completed more math problems than students utilizing SMA. Results were mixed for monitoring accurate productivity. Lam et al. reported that SMP procedures outperformed SMA procedures, but Lloyd et al. found that SMA produced slightly greater accuracy in student math problems. Although Maag et al. showed increased productivity, results were inconclusive for accuracy due to differential effects between students of different ages. Again, evaluation of Intermittent Production does not show that one procedure clearly yields superior outcomes.

Four studies employed the method we are calling Intermittent Accuracy (Maag et al., 1993; Roberts & Nelson, 1981; Rooney et al., 1985, comparison 2; Selznick & Savage, 2000). Of these four studies, two actually showed no increase over baseline in either productivity or accuracy (Roberts & Nelson, 1981; Selznick & Savage, 2000), and the other two showed no difference between SMA and SMP.

These results paint an uneven picture of the comparative effects of SMP and SMA, making it difficult to argue that one procedure is superior to the other. SMP might be ahead by a bit, if one simply counts the number of times that one condition is greater than the other, as shown in Table 1. However, the number of times when the two are essentially equal makes that lead look small.

Why is this the case? Are the procedures equivalent? Is one more effective under some circumstances and the other more effective under others? An alternative possibility is that there are idiopathic outcomes. That is, self-monitoring effects may interact with individual student's characteristics; for a certain subset of students, self-monitoring of one target behavior will be more effective, but for a different subset of students, self-monitoring of another target behavior will be more effective. Harris et al. (2005) suggested this possibility after finding results that conflicted with an earlier study. Our data set is not yet robust enough to establish decision rules about interactions using different self-monitoring methods depending on students' characteristics. Indeed, educators have not yet established decision rules for those differentiating instruction on the basis of learner characteristics in general (cf., Cronbach & Snow, 1977; Kavale & Forness, 1987; Pashler, McDaniel, Rohre, & Bjork, 2008).

Questions about whether the target or focus of intervention should be attention or performance are not limited to self-monitoring interventions. A similar debate arose in the 1970s in the behavior analysis community and led to highly focused studies. For example, Ferritor, Buckholdt, Hamblin, and Smith (1972) directly assessed the matter of bidirectional effects between attention and performance using an operant paradigm. While measuring attention, disruptive behavior, productivity, and accuracy in each of two experiments, they reinforced attention in one condition, correct work in another condition, and both attention and correct work in a third condition. They found that only one contingency trumped the other uniformly. Ferritor et al. concluded:

> Contingencies that increase attending behavior and reduce disruption do not necessarily increase student performance …. Contingencies on attending alone increased attending behavior and decreased disruptive behavior, but had little effect on the measures of correct work accomplished. Reinforcement contingencies for "correct work" alone increased the accuracy of work but had little effect on attending behavior and appeared to correlate with increased disruptive behavior. Only when reinforcement was contingent both for attending behavior and for correct work accomplished did we find increased attending, decreased disruptions, along with increased number of problems worked correctly. (1972, p. 16)

What can we learn from this parallel? Perhaps it is that, in the case of self-monitoring interventions, as in many other areas, we should not continue to pursue the one simple and pure method. There may be no *one, right-and-true target* for self-monitoring, no magic bullet. Instead, it may be that self-monitoring is a good component of broader interventions (e.g., SRSD) and, when self-monitoring is introduced as an intervention that is to stand on its own, we should heed the findings of Ferritor et al. (1972) and plan to focus on multiple target behaviors.

How teachers would implement a multicomponent self-monitoring procedure sounds like a challenge. And then there is the challenge of how researchers would assess its effects relative to all the other possible alternative variants of self-monitoring. In the course of our research for this chapter, we found two studies (Rooney et al., 1985; Wolfe et al., 2000) that combined SMA and SMP into one procedure. Rooney et al. compared SMA and SMP separately before combining them for one phase of their study. Results for neither study were conclusive. More research needs to be conducted comparing combined treatments to SMA and SMP individually.

Students with learning and behavior disorders characteristically have difficulties in academic performance and associated areas, one of which is attention to task (Hallahan, Lloyd, Kauffman, Weiss, & Martinez, 2005;

Kauffman & Landrum, 2009). Although parents, teachers, clinicians, psychologists, and others are often interested in the nature, causes, and assessment of these problems, the most pressing concern to everyone who knows children and youths with these difficulties is what to do to improve educational outcomes. Attention may be an epiphenomenon, a by-product of productive work, or it may be a precursor. The two may be so closely intertwined that it is impossible to separate them completely, making it even more important to focus interventions on whatever produces effects for given individuals. Thus, teachers, psychologists, and others who use self-monitoring – and just about any other intervention, for that matter – should routinely monitor its effects to ensure that the students with whom it is being employed are benefiting from it.

Our overall conclusion is that this literature is unsettled. Our colleagues and we have worked on it for many years. Although they may have better insights into it than do we, the answers to the questions we pose seem to lead us on an adventure – through a twisty set of caves. At present, we hope that teachers and other clinicians using self-monitoring will, in the spirit of the US individual educational program, focus any application of self-monitoring on the target behaviors of greatest concern for each individual student when using it as a specific treatment and recognize it as an important component of broader treatments when they see it in packages. In both cases, we hope it will be implemented with fidelity and kindness.

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