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RESEARCH ARTICLE

Effects of the SMART Classroom Curriculum to Reduce Child and Family Screen Time

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Evidence for adverse effects of screen media exposure has led to recommendations to limit children's screen time. This paper describes a randomized controlled trial of SMART (Student Media Awareness to Reduce Television), an 18-lesson, theory-based classroom curriculum to reduce screen time among third and fourth grade children in two matched public elementary schools (n = 181). Intervention school children significantly reduced their weekday television viewing and weekday and Saturday video game playing compared to controls. Greater effects were found among boys and more adult-supervised children. Mothers, fathers, and siblings and other children in intervention school households also reduced their television viewing. The findings demonstrate the efficacy of a classroom intervention to reduce screen time among elementary school children and their family/household members.

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The homes of U.S. children have an average of 2.9 TV sets, 1.8 video cassette recorders (VCR), and 1.4 video game players. One can find TV sets in half (53%) of children's bedrooms; one third (32%) of 2–7 year olds and two thirds (65%) of 8–18 year olds (Roberts, Foehr, Rideout, & Brodie, 2003). Children watch television and videotapes around 3 hours and play video games about a half-hour per day (Roberts et al., 2003; Woodard, 2000). On average, U.S. children spend more than a quarter of their waking lives in front of a television or other electronic media screen (Robinson, 2001).

Children's media use has been associated with a number of adverse effects. True experiments, cross-sectional studies, and longitudinal fieldwork consistently show that exposure to media violence is associated with more aggressive behaviors, desensitization to violence, and the belief that aggressive behavior is an appropriate reaction to conflict (Bandura, Ross, & Ross, 1963; Bushman & Huesmann, 2001; Johnson, Cohen, Smailes, Kasen, & Brook, 2002; Paik & Comstock, 1994). Excessive

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screen time leads to increased obesity (Dietz & Gortmaker, 1985; Robinson, 2001), consuming more fast foods (French, Story, Neumark-Sztainer, Fulkerson, & Hannan, 2001), eating fewer fruits and vegetables (Boynton-Jarrett et al., 2003), and being less physically active and fit (Robinson, 2001). Furthermore, reducing children's screen time results in less weight gain and obesity (Gortmaker et al., 1999; Robinson, 1999). A large body of evidence also suggests that television advertising can be harmful to children's health and development (Kunkel et al., 2004).

Evidence for the effects of media use on academic performance and social development has been less conclusive, though some studies have found associations between more television viewing and/or video game use and worse academic achievement, less time spent reading and doing homework, and greater risk for later attentional problems (Anderson & Collins, 1988; Christakis, Zimmerman, DiGiuseppe, & McCarty, 2004; Comstock & Paik, 1991; Hornik, 1981; Madden, Bruekman, & Littlejohn, 1997; Potter, 1987; Wiecha, Sobol, Peterson, & Gortmaker, 2001; Williams, Haertel, Haertel, & Wahlberg, 1982).

Parents report trying to mediate their children's media use. Some employ "restrictive mediation"; that is, parents forbid their children from watching certain programs, control viewing to certain times and limit the length of their children's TV viewing (Nathanson, 2002). In two recent national surveys, half to more than two thirds of parents report having household rules governing their children's media use (Annenberg Public Policy Center, 1997; Roberts, Foehr, Rideout, & Brodie, 1999). Parents' negative attitudes about television predicts the use of restrictive mediation, along with child's age and parents' level of involvement with the child (Nathanson; Warren, Gerke, & Kelly, 2002).

To decrease the negative effects associated with children's media use, some social, health, and political advocacy groups try to change the structure and content of media (Strasburger & Wilson, 2002). Others argue for reducing or eliminating children's screen time altogether (Trotta, 2001). The American Academy of Pediatrics advises that children aged 2 years and younger watch no television and that children older than 2 years limit television watching to a total of no more than 1–2 hours per day, and only educational, nonviolent programming (American Academy of Pediatrics Committee on Public Education, 2001). Other recommendations to limit children's screen time come from the American Psychological Association (1995), the American Academy of Child and Adolescent Psychiatry (2001), the American Medical Association (1996), the National Parent Teachers Association (2001), the National Education Association (1999), and the U.S. Surgeon General (2000), among many others. Since 1995, there also has been a national grassroots movement to encourage families to turn off their televisions for a week (*The TV Turnoff*, www.tvturnoff.org). Despite these widespread calls for parents to limit their children's screen time, little work has been conducted to discover the means to successfully do so. The question remains, how do we decrease use when these media activities are so central in the lives of U.S. children?

Surprisingly, few scientific studies directly focus on reducing children's television viewing. Rather, most research interventions try to teach children media

education and critical viewing skills (Corder-Bolz, 1982; Dorr, Graves, & Phelps, 1980; Huesmann, Eron, Klein, Brice, & Fischer, 1983; Roberts, Christenson, Gibson, Mooser, & Goldberg, 1980; Singer, Zuckerman, & Singer, 1980). Several recent studies, however, have attempted to reduce children's media use in order to reduce obesity. In one study, a 2-year, middle school curriculum was designed to reduce students' television and video viewing to less than 2 hours per day, increase physical activity and fruit and vegetable consumption, and decrease high fat food consumption (Gortmaker et al., 1999). Following treatment, students in the intervention schools reported reducing their television viewing more than controls. Another obesity prevention trial conducted with 77 preschool children included a TV viewing reduction component that emphasized a weeklong TV Turnoff coupled with increased book reading. At the end of the treatment period, children in the intervention group reported watching significantly less television than their peers in the control group (Dennison, Russo, Burdick, & Jenkins, 2004).

Prior to these intervention studies and our own television reduction study, the only studies to examine media reduction interventions were small and did not employ randomized controlled designs. Conducted around 20 years ago, these studies did demonstrate the potential efficacy of using behavioral strategies of self-monitoring, reinforcing reduced viewing, and budgeting television viewing time, at least among children who were excessive television viewers (Jason, 1983, 1985, 1987; Jason & Rooney-Rebeck, 1984; Wolfe, Mendes, & Factor, 1984). Contrasting the more recent work, media reduction was the primary objective of the earlier studies.

This paper reports the results of an experimental school-based intervention to reduce screen time among third- and fourth- grade elementary school children. The intervention addressed only reducing television, videotape, and video game use and did not specify any replacement activities to occupy time that was spent in front of the electronic video screen. This intervention, if successful, could have widespread practical and research applications. It could provide both a population-based approach to reduce children's television, videotape, and video game use, as well as an experimental model to study the effects of reduced media exposure on cognitive, behavioral, and physiological outcomes in real-world settings. In prior publications, we documented the impact of this intervention on body weight and fatness, physical activity, diet (Robinson, 1999), aggressive behavior (Robinson, Wilde, Navratil, Haydel, & Varady, 2001), and consumeristic behavior (Robinson, Saphir, Kraemer, Varady, & Haydel, 2001).

Bandura's (1986) social cognitive model provided the conceptual foundation for our intervention because the model is well grounded in experimental research, provides directives for the production of behavior-change interventions, and has demonstrated efficacy in previous school-based behavior-change research (Bandura, 1986, 1997; Killen et al., 1988). In social cognitive theory, behavior develops and is maintained through the reciprocal interplay of personal, behavioral, and environmental factors (Bandura, 1986). Within this context, the social cognitive model offers four processes that influence learning and adopting new behaviors, and are particularly helpful for designing behavior-change interventions: attention, retention,

production, and motivation (Bandura, 1986). To reliably apply the principles of social cognitive theory in our intervention, we were careful to focus specifically on these four processes in the design of all elements of the intervention.

The purpose of this paper is to (a) fully describe our intervention and its conceptual origin and design, (b) examine the effects of the intervention on reducing children's time with individual screen media and potential substitute activities, (c) examine the effects of the intervention on television viewing among parents and other household members, and (d) explore the role of baseline characteristics as potential moderators and of postrandomization intervention-related factors as potential mediators of the intervention's effects (Kraemer, Stice, Kazdin, Offord, & Kupfer, 2001; Kraemer, Wilson, Fairburn, & Agras, 2002).

Subjects and methods

All third- and fourth- grade students in two public elementary schools in one school district in San Jose, CA, were eligible to participate. Schools were sociodemographically and scholastically matched by school district personnel. All third and fourth grade teachers and their school principals agreed to participate in the study prior to randomization. Parents or guardians provided written informed consent for their children to participate in the school-based study, and for their own participation in telephone interviews. Children provided assent for their own participation. One school was randomly assigned to implement the SMART (Student Media Awareness to Reduce Television) curriculum to reduce television, videotape, and video game use. The other school was assigned to be an assessments-only control. All assessments were performed by trained staff, blinded to the experimental design and school assignment, at baseline (September 1996) and after the intervention (April 1997). Children, parents/guardians, and school personnel, including classroom teachers, were informed of the nature of the intervention and assessments prior to participation. The study was approved by the Stanford University Panel on Human Subjects in Research.

The intervention

The intervention's design was drawn primarily from Bandura's (1986) social cognitive model. In social cognitive theory, behavior develops and is maintained through the interplay of personal, behavioral, and environmental factors. Because our goal was to reduce children's screen time, we focused on *personal factors* that included the children's, parents' and teachers' value systems that determine the nature of the incentives that sustain media-use behaviors, expectations derived from observation and experience about the consequences of different behaviors (outcome expectancies), and expectations about personal abilities to perform behaviors that will secure desired outcomes (efficacy expectancies). *Behavioral* factors included the skills available in the behavioral repertoire of the child, parent, or teacher, and the degree of competence attained in using these skills. *Environmental* factors consisted of the ways in which peers, family members, teachers, supervisors, and even media characters and actors model various attitudes

and behaviors regarding television viewing, videotape viewing, and video game playing. Such individuals are positioned, through their own actions, judgments, or social positions, to influence the development of children's value systems and standards of conduct regarding those attitudes and behaviors. In addition, environmental factors include household or community factors such as media ownership or the availability of safe places to play in the neighborhood.

Prior to the intervention, we identified three primary approaches for reducing children's screen time. They were (a) nonselectively decreasing total television and videotape viewing and video game use, regardless of content or context; (b) selectively decreasing television and videotape viewing and video game use, by becoming more selective about content or context; and (c) displacing television and videotape viewing and video game use with other activities. Although the third mechanism, displacement of screen time with other activities, may hold great potential for reducing screen time, we chose *not* to use it in this study because we wished to investigate the hypothesized causal association between reduced television, videotape, and video game use and associated outcomes (e.g., school performance, obesity, physical activity, diet, aggression, consumeristic attitudes and behaviors, body dissatisfaction) in an authentic setting. To keep the experimental model "clean," it was important that the intervention targeted *only* reducing screen media use and did not include "contaminating" elements that could influence these related outcomes (e.g., alternative physical or academic activities).

Our intervention targeted nonselective and selective reduction of television viewing, videotape viewing, and video game use, without providing specific alternative or substitute activities. Nonselective approaches include (a) budgeting total weekly screen time and (b) limiting physical access to screen media (e.g., removing TV sets from the home, especially from kitchens and bedrooms; placing VCRs and video game players in cabinets; and/or hiding remote controls). Selective approaches to decreasing screen time include (a) limiting viewing of screen media to certain days of the week or times of day (e.g., not until after dinner and/or homework is completed, not on school nights), (b) restricting screen media use to only specified content (e.g., prohibiting media that has been rated as violent or sexually explicit, only watch shows broadcast on public television), and (c) limiting screen media use only to particular circumstances (e.g., playing video games only with a parent present, not watching television during meals).

Why target television, videotapes, and video games instead of television alone?

From an etiological research perspective, an intervention targeting only reduced television viewing might seem more pure than an intervention that tries to simultaneously reduce several types of screen media use. Of course, media may differ in how they impact children's health. For example, television programming that is regularly interrupted with commercials for sugary cereals and high-fat snack foods may have greater impact on dietary behaviors than videotapes that have no advertising (Gorn & Goldberg, 1982; Jeffrey, McLellarn, & Fox, 1982) and playing some video games can result in greater

energy expenditure than watching television or videotapes (Segal & Dietz, 1991). However, we decided to target television, videotapes, and video games for both conceptual and practical reasons.

In concept, time spent watching television resembles time spent watching videotapes and playing video games. To begin, different screen media can look very similar. Characters and storylines cross media frequently; children may be just as likely to see Rugrats or Muppets on television programs as they are to see them on videotapes or video games. In observing children using different media, one might have a difficult time distinguishing what type of screen media they were using. For most, use of these different media almost always involves being sedentary in an indoor setting. Even the child who is playing video games is sitting, manipulating a joystick that might be on his or her lap. And children come to the couch for similar reasons, whether they are watching television or videotapes or playing video games. Time spent using each of these media is also time that is not used for potentially more constructive activities, such as reading, doing homework, or playing outside. Displacement of other activities is frequently cited as a negative effect of media use. In our formative research, children also reported that they use all types of media either to be entertained or when they were bored. As well, parents and teachers may not consistently discriminate between these three media. Parents' and teachers' beliefs about the roles of these three media on, for example, time for homework and reading, socialization with other children, physical activity, or exposure to violence, adult language, and sexually explicit content may be linked to all these media. In focus groups with parents, we have heard individual preferences voiced for (and against) certain media, but most seem to differentiate according to media content. Therefore, targeting television alone, as a medium, may be inconsistent with a parent's own belief systems (e.g., "TV is not so bad but video games are much too violent, why aren't you focusing video games?"). Targeting all screen time but incorporating selective viewing intervention approaches allows parents to exert their own beliefs and preferences about individual media and/or content. Targeting all screen time, therefore, was expected to produce the greatest parent and teacher "buy-in" for the intervention, and providing this element of parental choice and control was designed to increase self-motivation for their participation in screen-time-reducing behaviors (Bandura, 1986, 1997).

The decision to target all three of these screen media was also guided by practical reasons. First, all three media are typically delivered via a TV set. We would be simplifying the intervention and reducing all screen media use if we instructed turning off or using electronic time managers connected to the households' TV sets. Second, we believed that addressing all three media would make for easier delivery of the intervention, for this study and for future work and dissemination. Pediatricians and educators can recommend reducing all screen time, rather than justifying why children need to reduce use of one medium more than another. A more inclusive intervention helps minimize situations where exceptions are made for particular programs, games, or individual children. This is also consistent with cognitive

social learning principles of setting explicit, nonambiguous, and measurable goals (Bandura, 1986).

Last, we wanted our intervention to operate in a real-world setting, so that our results might have the greatest clinical, practical, and policy relevance. Although it would be possible, despite the constraints already mentioned, to design a study to evaluate the overall and relative effects of an intervention targeting a single medium, such "component" studies seem premature given the current state of experimental research on media effects in real-world settings. Furthermore, many epidemiological studies examining the health and behavioral correlates of excessive viewing do not differentiate among these media. Without prior evidence of large differential effects, it was most appropriate to test the efficacy of a more comprehensive intervention before moving to more complicated component studies (Agras, Kazdin, & Wilson, 1979).

What about computer use?

Recent national data indicate that 67% of households with children aged 6–17 years have a personal computer, and average 6–11 year olds spend about 50 minutes per day using a computer (U.S. Census, 2001; Woodard, 2000). However, reducing time spent using computers may be more complex than reducing time spent watching television and videotapes and playing video games. In particular, many parents and teachers believe that using computers, unlike other screen time, is educational and prepares children to be competitive in future job markets, especially near Silicon Valley where we conducted this research. Therefore, we did not indiscriminately combine all computer use with other screen media use. As part of the intervention, we explicitly recommended that parents include computer "games" and "playing on the computer" in the total weekly screen time budget. We suggested that parents try to discern between playing games versus educational or school work done on the computer. Our formative research suggested that excessive computer use would be a significant problem for few children, and that this approach would be satisfactory to both parents and teachers. This was also consistent with our emphasis on including opportunities for choice and control for both parents and children, to enhance motivation for reducing screen time (Bandura, 1986).

The SMART classroom curriculum

We delivered a classroom curriculum in all four third and fourth grade classrooms in the intervention school over a 6-month period (October 1996 to April 1997). The curriculum consisted of eighteen, 30- to 50-minute classroom lessons plus weekly 5- to 10-minute boosters over the course of the last 4 months. Social cognitive theory suggests that "induction," "generalization," and "maintenance" of effects are conceptually distinct processes in behavior change, with each phase at least partly determined by different factors (Bandura, 1986). Classroom lessons were designed and scheduled accordingly, with more frequent and intensive activities focusing on maximizing attention and motivation for participating in early mastery experiences in the months of October through December to promote enhanced self-efficacy for initial adoption and generalization of behavior changes. These lessons were followed by a combination of brief, regularly scheduled

reinforcing activities and moderately intensive, intermittently scheduled activities over the rest of the school year to promote self-efficacy for maintaining changes or reinstituting lapsed behaviors. Teacher preparation consisted of a 3-hour group curriculum orientation session with all classroom teachers, led by the principal investigator and a research assistant. The goal was to provide teachers with sufficient familiarity with the curriculum and brief mastery experiences to boost perceived efficacy for implementing the curriculum with success (Bandura). Orientation to the entire curriculum and mastery experiences were also intended to have a positive impact on other variables important to program implementation, such as teacher enthusiasm, reduced anxiety, and perceived preparedness to deliver the curriculum (Parcel, Perry, & Taylor, 1990). Four regular classroom teachers taught all classroom lessons, but the research assistant prepared materials and provided ongoing advice and feedback to facilitate implementation. Ready access to the research assistant, as a resource person, was also designed to enhance classroom teachers' efficacy expectancies for curriculum delivery.

As noted above, social cognitive theory specifies four processes that influence learning and adopting new behaviors, and are particularly helpful for designing behavior-change interventions: attention, retention, production, and motivation (Bandura, 1986). *Attention* regulates exploration and perception; it is highly influenced by factors such as salience, conspicuousness, functional value, affective valence, and attractiveness. *Retention* is influenced by the processes of symbolic coding, information organization, cognitive or imagined rehearsal, and enactive rehearsal. *Production* is the conversion of conceptual representations into actions, is influenced by immediate intrinsic and extrinsic feedback, and is the process most closely linked to efficacy expectancies. *Motivation* is linked to both outcome expectancies and perceived self-efficacy and is strongly influenced by external, vicarious, and internal incentives. These four processes guided the macro- and microdevelopment and implementation of specific intervention components. Therefore, all elements of the curriculum were subjected to particular scrutiny to ensure that they included (a) stimulus material and specific lesson activities that would engage and direct the attention of the children, (b) intervention formats and content (i.e., language and skill demands, information level, activity complexity) that matched the cognitive and behavioral skill levels of third and fourth grade children, (c) sufficient cognitive and behavioral performance opportunities to provide mastery experiences, and (d) incentives and incentive systems that were relevant and attractive to the children, and thus more likely to serve as prompts for action. For example, we attempted to maximize attentional processes with techniques such as using boldly colored materials that differed in form and style from the rest of their curricula, including music and art in lessons, making lessons highly interactive and participatory, using content that emphasized meaningful short-term consequences of behaviors that were meaningful to third and fourth grade children instead of future long-term outcomes, and specifying incentives prior to the learning activities. We aimed to maximize retention by using methods like presenting explicit instruction for new skills along with linked visual demonstrations and using simple stories and

simulation activities that allowed children to infer the intended messages. Production processes were maximized by including many opportunities for practicing skills and mastery through role-playing and simulations, with feedback to highlight successes and correct deficiencies, and including activities such as self-monitoring screen time, calendar planning, inventing strategies to overcome common barriers to reducing screen time, and making persuasive appeals to reduce television viewing to peers and younger students. Finally, motivational processes were maximized for both reducing screen time and participating in the intervention activities themselves by creating opportunities to achieve peer, parent, or teacher approval for successfully performing the targeted behaviors; providing some material extrinsic rewards such as ribbons, stickers, and classroom honors; using stories and simulations for children to observe modeled behaviors linked to desirable outcomes; and emphasizing perceived choice and control, as well as personalization, contextualization, challenge, curiosity, and mastery, factors that have been demonstrated to enhance intrinsic motivation, greater persistence, better performance, and higher satisfaction in children (Cordova & Lepper, 1996; Lepper, 1985; Parker & Lepper, 1992).

The curriculum consisted of four sections, which were delivered in the following order:

1. *TV awareness*. Five lessons focusing on TV awareness were intended to (a) increase children's awareness of the roles television, videotapes, and video games play in their lives; (b) inform children about the potential short- and long-term consequences of watching a lot of television and videotapes and playing a lot of video games; and (c) promote positive attitudes and motivation to reduce television, videotape, and video game use. These lessons included self-monitoring exercises (and homework to self-monitor television, videotape, and video game use for a week), in-class reporting and self-identifying activities they liked to do when not watching television, reading a story about TV taking over a child's life, and inventing individualized endings to model potential outcomes and stimulate children to form their own outcome expectations for reducing screen time, and a lesson "The world really wants to know: Are American kids addicted to TV?" to excite the students about participating in their own scientific "experiment" and the challenge of the upcoming TV Turnoff to boost intrinsic motivation. In sum, these lessons were designed to provide opportunities for greater behavioral awareness, elicit social support for watching less TV, and heighten the perceived incentive value of the TV Turnoff and reducing screen time. These lessons helped children form expectations regarding anticipated positive and negative outcomes of either maintaining current levels of screen time or reducing their screen time.

2. *The TV Turnoff*. These five lessons occurred during a 10-day TV Turnoff (Winn, 1987; *The TV Turnoff*, www.tvturnoff.org). During the TV Turnoff, children attempted to watch no television or videotapes and play no video games for 10 days. The TV Turnoff and the accompanying lessons were intended to provide an "inoculation" experience (McGuire, 1964) to help children (a) learn new strategies to resist watching television and videotapes and playing video games; (b) invent and practice

skills to reduce television, videotape, and video game use; (c) experience positive outcomes from reducing television, videotape, and video game use, enhancing outcome expectations; and (d) experience mastery in controlling screen time, increase their perceived self-efficacy for reducing television, videotape, and video game use. As part of this phase, we included an excitement-filled "kick-off ceremony," in which children assembled and committed to take the challenge of the 10-day TV Turnoff. The challenge aspect was highlighted to enhance motivation. The highlight of the kick-off ceremony was arrival of a research staff member in a gorilla suit, who taught the children a parody of the then- popular song and dance "the *Macarena*," called "the No-Watcherena," to promote greater attention to and retention of the TV-Turnoff tasks. Subsequent lessons included role-plays of specific tough situations to build perceived self-efficacy, drawing their own "portrait of a TV Junkie" to reinforce negative expected outcomes of excessive screen time, and a "closing ceremony" where school officials and community leaders acknowledged the students for trying and/or succeeding in meeting the 10-day TV-Turnoff challenge. The classroom with the greatest proportion of turnoff participants was awarded a trophy. Although tangible rewards were included during the turnoff, a particular emphasis was placed on building self-satisfaction for accomplishing goals, as self-evaluative outcomes are often stronger influences on behavior than tangible rewards (Bandura, 1986).

3. *Staying in control.* Following the TV Turnoff, the next four lessons helped children set and adhere to a more modest goal of 7 hours per week of media use. We used this goal because our prior research suggested that this would be a substantial decrease for most children, as well as a challenging yet realistic objective. Broad evidence indicates that explicit challenging goals increase motivation (Bandura, 1986; Locke & Latham, 1990). To promote perceived choice and control among children, we recommended that teachers guide their students into coming up with the 7 hours per week budget, "by themselves." All classrooms did choose 7 hours for their goal budget. The Staying in Control lessons helped children (a) build additional skills to resist social and environmental influences promoting excessive television, videotape, and video game use; (b) develop high levels of perceived self-efficacy for performing the skills learned; and (c) remain motivated to maintain reduced media use. As a result, these lessons highlighted opportunities for skills mastery and included brief role-playing exercises for dealing with difficult situations, problem solving for long weekends and vacations, and "planning ahead" exercises to help them stay within their budgets by being more selective about what they watch or play. These lessons set the stage for the subsequent 4–5 months.

During this section, students also learned about and received the TV Allowance. The TV Allowance (TV Allowance, Miami, FL) is a set-top electronic television time manager that monitors and controls television use with a personal identification number (PIN) for each member of the family. The TV Allowance allows parents to set weekly time budgets for their children, and also can block use during certain times of the day or week. Because it controls electrical power to the TV set, it also controls VCR and video game use. When a child's weekly budget expires, the

television set turns off and cannot be turned on again with his/her PIN until the budget replenishes at the beginning of the following week. Children practiced selecting a "secret code" PIN during a classroom lesson, creating additional motivation to use the TV Allowance at home. We gave each student a TV Allowance to take home and informed parents that they could request additional units, at no cost, for all the television sets in their home. We customized an easy-to-read instruction manual to help simplify set up of the TV Allowance and suggested methods to account for budgeting over multiple TV sets and multiple children in a household. We also provided a toll-free "SMART Hotline" to help parents over the telephone or for parents to request additional TV Allowances. In a few cases when parents were unable to solve their problems over the Hotline, a research assistant went to the participants' homes to help them set up the TV Allowance in person. Because feedback on performance heightens motivation to achieve goals and the accompanying personal satisfaction (Bandura, 1986; Bandura & Cervone, 1983), the TV time manager also was intended to partially reduce the burden on parents to monitor and enforce children's screen time and to help provide children with ongoing feedback on their performance (i.e., staying under budget goals).

This section of the curriculum also introduced an incentive system for children who maintained their weekly media-use budget. Every Friday during the intervention, there was a 5- to 10-minute "SMART Talk," when children reported their successes and received peer recognition for turning in a "SMART Slip." The SMART Slip was a form signed by parents, confirming that the child adhered to his or her budget over the past week. Thus, the weekly SMART Slips produced opportunities for parental awareness and reinforcement of goals and achievements by their children. The SMART Talks created a classroom environment of teacher and peer recognition and social support for achievement of goals. Red, bronze, silver, and gold desk ribbons and "certificates of accomplishment" were awarded for cumulative counts of 5, 10, 15, and 20 weeks within budget, respectively, also providing graduated levels of challenge and mastery to enhance intrinsic motivation. This design feature drew upon prior research and theory that self-motivation is generally best sustained by a series of proximal subgoals that are hierarchically arranged to lead to longer-term goals (Bandura, 1986; Locke & Latham, 1990).

4. *Helping others*: After several months of using the TV Allowance and engaging in "SMART Talks," four more lessons occurred in Spring 1997. These lessons were intended to (a) support children's positive attitudes about reducing time spent using media, (b) reinforce children's perceived self-efficacy for the skills they were engaging in, and (c) help motivate children to maintain their behavior changes. Our experience is that advocacy to help peers is a highly motivating activity for school-age children. It also provides opportunities and reinforcement for repeated cognitive and enactive rehearsal of arguments for reducing screen time and the skills used to influence both outcome expectancies and self-efficacy. Students were enlisted to help third- graders at another school overcome their "addictions" to television, videotapes, and video games. Children wrote two-paragraph letters to the other students to

persuade them to reduce their screen time and tell them which methods work best. Children then read out the letters to their own classmates before they were mailed. Children also painted a mural to publicly display all the fun things they found themselves doing (and planned to do) because of their reduced screen time. These advocacy activities were designed to alert students to discrepancies between their behavioral goals to reduce screen time and their own screen-use behaviors and then to nominate and cognitively rehearse the strategies they considered most effective to reduce these discrepancies to achieve their goals as well as the positive outcomes expected to accompany their goal behaviors. Reducing perceived discrepancies between goals and performance is considered central to self-motivation (Bandura, 1986).

Parent newsletters

In a review of parent intervention research for school-based health promotion, Perry and colleagues concluded that (a) children are able to influence the attitudes and behaviors of their parents, (b) poor parent participation rates are a substantial barrier to implementing parent/family-based interventions, and (c) parents prefer interventions involving their children that can be completed at home (Perry, Crockett, & Pirie, 1987). Our experience has been consistent with these conclusions. Because most families are unlikely to accept face-to-face interventions, given their inherent intrusiveness and time commitment, we created an engaging, informative, and noninvasive parent newsletter. Fourteen *SMART Kids, SMART Families* parent newsletters were sent to parents of students in the intervention school. We designed the newsletters to (a) inform parents of the potential benefits of reducing their children's television, videotape, and video game use; (b) motivate parents to help their children reduce their media use; (c) suggest strategies to help their child and the entire family; (d) offer ideas for implementing selective viewing policies; (e) teach contingency management skills to help them support their children's behavior changes; (f) provide public recognition for children staying under their budgets; and (g) create a stronger connection with their children's school and classroom by updating parents on the SMART classroom activities.

Child measures

At baseline and post-test, on the same days in both schools, children completed self-report questionnaires during 40-minute class periods on two separate days. A research staff member read each question aloud and students followed along and marked their responses in the survey booklets. Teachers did not participate in the assessments.

Demographics and household media environment

Children reported their date of birth; age in years; sex; number of TV sets, VCRs, and video game players in their home; and whether there was a television in their bedroom (Robinson, 1999).

Media use and other activities

After a series of participatory time-estimating exercises, repeated on each day, children reported the time they spent "Watching television (not including videos on a VCR)," "Watching movies or videos on a VCR," "Playing video games (like Nintendo or Sega, not

including games on a computer)," "Playing on a computer (not including homework)," "Doing homework (including reading a book or magazine for school or working on a computer)," "Reading a book or magazine NOT for school," "Listening to music on the radio, tapes, or CDs," "Playing a musical instrument," "Doing artwork or crafts (like drawing, painting, and making things)," "Talking with your parents," "Playing quiet games indoors (like playing with toys, puzzles, or board games)," and "At classes or clubs (like Brownies, Cub Scouts, religious school, or Judo classes)." Children completed the list first for "Yesterday before school, from when you woke up until the start of school" and then for "Yesterday after school, from the end of school until you went to bed," on an 8-item scale: none, 15 minutes or less, 30 minutes, 1 hour, 2 hours, … 6 hours or more. On the first assessment day, children similarly reported time spent watching television, movies, or videos in a VCR; playing video games; and playing on a computer, for "Last Saturday in the morning (from when you woke up until noon)" and "Last Saturday in the afternoon and evening (from noon until the time you went to bed)." This instrument was adapted from a similar instrument previously used with young adolescents with high test-retest reliability (r = .94) (Robinson & Killen, 1995) and piloted with direct video observation in children in this age group (Borzekowski & Robinson, 1999).

Parent measures

Trained research staff interviewed parents by telephone at baseline and posttest. At least 10 call attempts were made at various times of day and different days of the week, and up to three messages were left on answering machines, before classifying a parent as a non-respondent. Mothers or female guardians were requested for interviews, but fathers or male guardians were interviewed if mothers were not available. We completed all the parent interviews within a 23-day period at baseline and a 36-day period at posttest, with more than 85% of interviews performed during the first 16 days of each assessment period.

Demographics

Parents reported the ethnicity of their child, the highest education level completed for all parents or guardians living in the household, and their marital status (Robinson, 1999).

Household composition and television viewing

For themselves and every member of the participating child's household, parents reported specific relationship to the participating child, sex, age (for minors only), and "hours of television viewing in a typical week."

Intervention participation

After completing the posttest parent phone interview, experimental assignment was unblinded to interviewers, and parents of children in the intervention school were asked how often they read the parent newsletters (7-point Likert scale ranging from *never* to *all of the time*), if they used the TV Allowance, and, if yes, whether they were still using the TV Allowance.

Statistical analysis

We assessed baseline comparability of treatment and control groups using nonparametric Wilcoxon rank sum tests for scaled variables and chi-square tests for categorical variables.

To test the hypothesis that the intervention reduced television, videotape, and video game use, we used analysis of covariance (ANCOVA) with the posttest measure as the dependent variable, the intervention group (intervention vs. control) as the independent variable, and the baseline value of the same measure as a covariate. This analysis assumes that there is no nonzero correlation between the subjects' responses within a school. Because randomization was by school, and students within a school may have correlated responses, we also checked this assumption by repeating the analysis using a mixed-model ANCOVA (SAS MIXED procedure, SAS version 8.0, SAS Institute, Inc., Cary, NC), which adjusts for observed between-subjects correlations within schools (Murray, 1998). As expected, this analysis produced the same results. In no single case did the mixed-model ANCOVA result differ in statistical significance from the standard ANCOVA, suggesting intraclass correlations approximating zero. Therefore, all reported effect sizes, confidence intervals, and p values are derived from the simpler, standard ANCOVA. Consistent with intention-to-treat principles, all students were analyzed in their schools as randomized, regardless of their participation or compliance with the intervention or whether they transferred between schools between baseline and posttest, and all available data were included in the analyses. Tests of statistical significance were two-tailed with $\alpha = 0.05$. With this analysis and an anticipated sample size of approximately 100 participants per group, the study was designed to have 80% power to detect an effect size as small as 0.2 standard deviation units (Kraemer & Thiemann, 1987).

Results

At baseline, 105 third and fourth graders were enrolled in the intervention school and 120 third and fourth graders were enrolled in the control school. Ten students from the intervention school (9.5%) and 18 students from the control school (15%) did not have parental consent to participate in the study. We also excluded self-report survey data a priori for two students from the intervention school and nine from the control school, because their teachers classified them as having a significant learning disability or limited English proficiency and were concerned about their ability to complete the surveys, resulting in baseline samples of 93 students in each school. Posttest surveys were completed by 92 children in the intervention school and 89 children in the control school (baseline to posttest retention rates of 99% and 96%, respectively), making up the analysis sample for this study. The children lost to follow-up included three control school children who moved and one student in each school who was absent during data collection. Intervention and control children were comparable in age (mean [*SD*] 8.9 [0.6] vs. 8.9 [0.7] years, $p = .51$), sex (44.6% vs. 47.2% girls, $p = .72$), mean [*SD*] number of TV sets in the home (2.7 [1.3] vs. 2.7 [1.1], $p = .80$), mean [*SD*] number of VCR's in the home (1.7 [0.9] vs. 1.8 [0.9], $p = .76$), mean [*SD*] number of video game players (0.7 [0.5] vs. 0.6 [0.5], $p = .32$), and percentage of children with a bedroom TV (43.5% vs. 42.7%, $p = .92$).

In the intervention and control schools, 68 (73.9%) and 67 (75.3%) of the parents or guardians of participating children, respectively, completed both baseline and posttest telephone interviews. Participating intervention school parents reported

greater maximum household education levels than control school parents (87.5% vs. 70.9% with at least some education beyond high school, $p = .01$) but did not differ significantly in ethnicity (80.6% vs. 77.2% White, $p = .62$), sex of respondent (81.9% vs. 87.2% female, $p = .37$), or marital status (76.4% vs. 67.1% married, $p = .21$).

Intervention implementation and participation

Teachers reported teaching all lessons although we did not collect student attendance data to estimate the classroom intervention dose for individual students. Ninety-five percent of students in the intervention school sample participated in at least some of the TV Turnoff (i.e., submitted at least one signed parent confirmation slip), and 71% completed the entire 10 days without watching television and videotapes or playing video games (mean [*SD*] = 7.9 [3.6] days). Forty-two percent of parents returned slips reporting they had installed the TV Allowance, and 20% requested one or more additional TV Allowances (range = 1–3 additional). However, among the subgroup of intervention school parents participating in post-test telephone interviews, 70% reported using the TV Allowance, and 72% of them (therefore at least 50% of the entire intervention school sample) reported they were still using the TV Allowance at posttest. Almost all interviewed parents (92%) reported reading at least one *SMART Kids, SMART Families* newsletter, 55% reported reading more than half of the newsletters, and 37% reported reading all 14 newsletters. Over the budgeting phase of the intervention, 58% of students turned in at least one parent-signed SMART Slip indicating they had stayed under their weekly budget (mean [*SD*] = 8.0 [9.0] weeks; range = 0–29 weeks).

Effects of the intervention on children's screen media use

We report baseline and posttest estimates of students' screen media use in Table 1. At baseline, students from the intervention and control samples were similar with respect to

Table 1 Weekday and Saturday Hours Per Day of Television, Videotape, and Video Game Use

	Mean Hours (*SD*) Per Day				Adjusted Difference (95% CI)[a]
	Baseline		Posttest		
	Intervention	Control	Intervention	Control	
Television viewing					
Weekday	1.78 (1.67)	1.86 (2.07)	1.14 (1.38)	1.96 (1.95)	−0.79 (−1.22, −0.35)***
Saturday	3.17 (3.22)	3.03 (3.36)	1.76 (2.41)	2.42 (2.74)	−0.70 (−1.42, 0.03)
Videotape/video cassette recorder viewing					
Weekday	0.51 (0.88)	0.71 (1.58)	0.36 (0.63)	0.62 (1.21)	−0.18 (−0.42, 0.06)
Saturday	1.14 (1.79)	0.98 (1.78)	0.81 (1.36)	1.04 (1.71)	−0.23 (−0.69, 0.23)
Video games					
Weekday	0.27 (0.67)	0.48 (1.47)	0.19 (0.59)	0.52 (1.23)	−0.24 (−0.48, −0.01)*
Saturday	0.56 (1.25)	0.72 (1.68)	0.31 (0.76)	0.90 (2.49)	−0.53 (−1.04, −0.01)*

[a] Adjusted differences are intervention minus control group mean differences at post-test, adjusted for pretest values with analysis of covariance.

* $p < .05$. *** $p < .001$.

their screen time (all $p > .24$). Effects of the intervention are presented as adjusted post-test differences and 95% confidence intervals with accompanying p values. Intervention school children significantly reduced their weekday television viewing and weekday and Saturday video game playing compared to children in the control school. The results did not change when we repeated this same analysis for separate morning and afternoon/evening estimates of media use. Therefore, all results are presented as full-day estimates.

There were no significant differences between groups in changes in self-reported weekday time spent playing on a computer (adjusted difference [95% CI] = −.23 [−.48, .03], $p = .08$), Saturday time spent playing on a computer (−.07 [−.39, .25], $p = .66$), time spent doing homework ($p = .23$), reading ($p = .64$), listening to music ($p = .39$), or doing artwork or crafts ($p = .77$). Reported occurrences of playing musical instruments, talking with parents, playing quiet indoor games, and attending classes or clubs were too small to allow for valid analysis.

Effects of the intervention on parents and other household members' television viewing

To assess the effects of the intervention on household television viewing, we analyzed data provided by the interviewed parent or guardian regarding weekly hours of television viewing for (a) mothers, including biological, step, and adoptive mothers, and female guardians ($n = 64$ in the intervention sample and $n = 62$ in the control sample); (b) fathers, including biological, step, and adoptive fathers, and male guardians ($n = 56$ in the intervention sample and $n = 47$ in the control sample); and (c) each sibling and/or other minor living in the same household at the time of the interview. In this analysis of viewing changes, we averaged viewing estimates across all siblings and other children in each household ($n = 55$ and $n = 58$ for siblings and other children in the intervention and control samples, respectively). Intervention and control samples were comparable on the number of siblings and other children per household (1.3 vs. 1.5, respectively, $p = .31$), the mean ages of siblings and other children (9.1 vs. 9.0 years, respectively, $p = .90$), and total household size (4.3 vs. 4.3 people per household, respectively, $p = .78$). We show the baseline and post-test estimates of household members' weekly television viewing in Table 2. We observed no significant baseline differences between the intervention and control samples for hours of television viewing by the mother or female guardian ($p = .11$), the father or male guardian ($p = .11$), and siblings and other children ($p = .34$). At posttest, however, all intervention sample household members significantly reduced their television viewing compared to control school household members.

Moderators of changes in children's television, videotape, and video game use

To identify subgroups of the intervention school sample that had greater or lesser responses to the intervention, we examined a number of baseline factors in a moderator analysis. Awareness of potential moderators can be useful for appropriate targeting of interventions, identifying particular inclusion/exclusion criteria in future studies, or determining factors on which studies may be stratified to amplify power (Kraemer et al.,

Table 2 Other Household Members' Hours Per Week of Television Viewing

	Mean Hours (*SD*) Per Week				Adjusted Difference (95% CI)[a]
	Baseline		Post-test		
	Intervention	Control	Intervention	Control	
Mothers or female guardians	10.46 (10.76)	11.48 (8.40)	8.80 (8.97)	12.49 (9.92)	−3.09 (−5.74, −0.44)*
Fathers or male guardians	11.14 (8.66)	15.67 (12.45)	10.21 (7.42)	16.16 (11.33)	−3.93 (−7.17, −0.69)*
Siblings and other children	11.76 (8.41)	12.59 (8.69)	8.38 (5.96)	12.51 (7.80)	−3.79 (−6.02, −1.56)***

[a] Adjusted differences are intervention minus control group mean differences at post-test, adjusted for pretest values with analysis of covariance.
* $p < .05$. *** $p < .001$.

2002). For this, we combined weekday and Saturday estimates into a summed weekly estimate, multiplying the weekday estimate by 5 and the Saturday estimate by 2. We then used the same ANCOVA approach used above but also adding in each potential moderator variable and the treatment by potential moderator interaction term as additional covariates. A significant interaction term indicates that that variable acts as a moderator of the intervention effect. This analysis was also done separately for each of the three outcomes of children's reported television viewing, videotape viewing, and video game use. Potential moderators tested in this manner included baseline screen media use, sex, number of siblings and other children living in the household, total number of persons living in the household, number of television sets in the home, number of VCRs in the home, presence of a television set in the child's bedroom, number of video game machines in the home, ownership of a handheld video game machine, presence of a computer that the child was allowed to use in the home, baseline levels of household television use, parent attitudes about television, parent policies about television, family rules about television, whether the child spent any time in child care, and whether the child spent any time alone unsupervised by an adult.

We found several baseline factors to be statistically significant moderators of the intervention effect. Reductions in television viewing in response to the intervention were greater among boys than among girls ($p = .05$), among children who spent no time alone, unsupervised by an adult ($p = .03$), and among children who watched more television prior to the intervention ($p = .05$). In addition, we observed the intervention to be most effective at limiting videotape viewing and video game playing among children who reported no videotape or video game use prior to the intervention ($p = .04$ and $p = .05$, respectively). In other words, the intervention effects were most pronounced for preventing subsequent onset or increases in videotape and video game use among baseline nonusers. There were no other statistically significant moderators.

Mediators of changes in children's media use

To better understand intervention-related factors related to individual response to the intervention, we used a similar ANCOVA approach to identify potential mediators of

changes in children's reported television, videotape, and video game use. Knowing mediators can inform and advance the investigation of causal mechanisms (Kraemer et al., 2002), including shedding light on the relative importance of various elements of the intervention model. Potential mediators tested included the number of days reported with no television, videotapes, or video games during the TV Turnoff, whether or not the TV Allowance was reported to have ever been hooked-up, the number of additional TV Allowances requested, whether the TV Allowance was still being used at the posttest interview, the proportion of newsletters the parent reported reading, and the number of underbudget SMART Slips the child turned in during the budgeting phase of the curriculum. In these analyses, none of these factors were found to be statistically significant mediators of changes in television viewing, videotape viewing, or video game playing.

Discussion

This study demonstrates the efficacy of a social cognitive theory–based classroom intervention to reduce children's screen time, as well as to decrease television watching among their parents, siblings, and other household children. At the end of the intervention, third and fourth graders in the intervention school were spending about 14 hours a week using electronic media, while students from the matched control school were spending about 24 hours per week. Statistically significant differences were seen for weekday television viewing and weekday and weekend video game use with substantial, but nonsignificant, trends in Saturday television viewing and weekday and Saturday videotape viewing. The results provide additional support for the validity of social cognitive theory as a conceptual model for interventions to influence complex behaviors, such as screen media use.

Although effects were seen across all students, moderator analyses revealed a number of subgroups that responded more or less to the intervention. First, differences between boys in the intervention and control schools were greater than differences between girls; boys in the intervention school decreased their television watching by about 6 hours per week compared to boys in the control school, who increased their television watching by about 1 hour per week during the course of the study. Girls in the intervention and control schools reported decreases in their television watching of about 7 hours and 2 hours per week, respectively. Our intervention was designed to apply social cognitive theory principles for both boys and girls, and thus we do not have an explanation for these differential effects of the intervention. Because substantial decreases were seen in both sexes, we do not think the curriculum is necessarily suited more to boys than to girls. It is possible that these differences reflect sex differences in normal trajectories of television viewing from fall to spring at these ages.

Baseline media use also moderated some intervention effects. The intervention produced greater magnitude effects on television watching among children who started as the heaviest TV viewers. In contrast, the intervention had a bigger effect on videotape and video game use for students who reported the least videotape or video game use at baseline. Although these results seem contradictory on the surface,

they all may indicate that the greatest effects are observed among those students with the most room to change (children who watch the most TV at baseline and children who are not yet playing video games and watching videotapes). Because the goal was to keep total screen time to 7 hours per week or less, successful budgeting would create greater magnitude differences among heavy baseline viewers. Heavy baseline television watchers might also be more responsive to the intervention because we designed the curriculum to influence children's outcome expectancies through establishment of perceived social norms. Lessons were designed to help children associate negative outcomes with greater screen time and positive outcomes with reducing screen time. Activities such as reporting one's baseline TV hours viewed and seeing them graphed with the rest of one's classmates would be expected to create greater perceived social pressure for change on those who were heavy viewers. In addition, intrinsic motivation to change might be greater for those whose behavior was more discrepant from the standard (Bandura, 1986; Locke & Latham, 1990).

Finally, children who were rarely left alone without adult supervision responded the most to the intervention compared to those with less adult supervision. This result may suggest that children who experience more adult supervision receive more help from household adults in limiting their television watching and/or that adult supervision is a proxy for greater child behavioral change skills or environments that are more supportive of changes in media use. Social cognitive theory would predict that children whose parents or guardians are more supportive of their attempts to reduce their screen viewing time would develop more positive outcome expectations and greater perceived self-efficacy for decreasing screen time by seeing their parents model screen-limiting behaviors, receiving more immediate feedback about their screen-viewing behaviors from their parents, and receiving more reinforcement for successful behavior change. More adult supervision allows for more opportunities to model desired behaviors, observe children's behaviors and provide immediate feedback, and provide rewards for successful behavior change. Although a number of other home environmental characteristics also would be expected to either facilitate or deter behavioral changes, variations in other household factors were not statistically significant moderators of intervention effects, including household composition and size, existing parent attitudes, policies and rules about television watching, and the screen media present in the household. Because statistical power was limited to detect interactions, however, statistical significance is a conservative standard and cannot fully rule out that some of these factors might also moderate intervention effects.

None of our measures of intervention participation proved to be statistically significant mediators of individual intervention responsiveness. This included whether or how long the family used the TV Allowance television time manager. This small study, therefore, does not allow us to conclude whether individual components of intervention participation were more or less important in reducing children's screen time. Again, because statistical power was limited to detect interactions, we cannot rule out that some of intervention components might be more likely than others to be in the causal pathway for reducing screen time. Our findings also do not support

claims that screen time displaces homework, recreational reading, listening to music, or doing arts or crafts, as children in the intervention school did not report increased time spent in these other activities, compared to controls. Like all null results, conclusions drawn from these findings must be made cautiously because children's self-reports of time use may suffer from substantial measurement errors, reducing statistical power to detect differences. These results also leave it unclear what students from the intervention school did when they reduced their screen time. As reported, the prevalences of many measured activities were too small to satisfactorily test for differences between groups. This may also suggest that there is a large variety of activities with which individual children replace their screen time. Larger studies with more objective measures of time use may be necessary to answer this question.

This is the first study to report that a classroom curriculum targeting students' media use can also reduce television watching by other members of their households. Among intervention school households, students' mothers, fathers, siblings, and other children living in the home watched about 3–4 hours per week less television than control school household members. This result supports the potential of intervening with children in schools to influence parent and sibling behaviors at home. This finding is consistent with the experiences of some other school-based health promotion interventions that have impacted the home environment (Perry et al., 1987). In our formative research leading to the present study, we were impressed that targeting children directly for television reduction was more successful than targeting their parents directly. Based on interviews with individual families, our impression was that parents, even apparently motivated parents who had volunteered to participate in a study because they wanted to reduce their children's television viewing, had too many other competing priorities to balance, resulting in less follow-through with intervention activities. In contrast, when children became motivated by the intervention activities, they were able to draw their parents into the process, making it a higher family priority. These qualitative observations helped reinforce our decision to target children directly with the intervention through a classroom curriculum. They also highlight the importance of paying special attention to motivational processes in designing behavior-change interventions (Bandura, 1986).

We are confident in our findings, even though the study only involved two elementary schools. Although it is possible that the results were due to differences in the intervention and control groups that were unrelated to the intervention, this is not very likely because the schools were drawn from a single school district, the schools were matched by school district administrators prior to randomization, and participants were comparable at baseline on almost all measured variables, including all baseline screen media use variables, and household media ownership. Another potential limitation is that we relied on self-reports and parent reports of screen time. To try to minimize this limitation, we used very detailed measures that have face validity and have proven to be highly reliable in prior studies (Robinson & Killen, 1995). Some studies suggest that self- and parent reports of television viewing are valid (Anderson, Field, Collins, Lorch, & Nathan, 1985), though we acknowledge

that self-reports have many weaknesses (Borzekowski & Robinson, 1999). In addition, we employed a randomized controlled trial design where data collectors were blinded to intervention assignment. Students, parents, and teachers were blind to the specific study hypotheses although it was impossible, of course, to blind them to the fact that they were receiving a curriculum to reduce screen time. Last, if participants were trying to impress our data collectors, we presume that they would have reported that they were adhering to the 7-hour per week screen time budget, rather than exceeding it by an average of twice that amount, and they would have reported increased time doing publicly sanctioned activities such as reading and doing homework.

The intervention's success may be a consequence of its strong theoretical foundation. We put great attention into creating a feasible curriculum that engages and motivates children, teachers, school administrators, and family members to comply with the intervention's objectives and components. As described above, the social cognitive model (Bandura, 1986) served as the conceptual foundation for intervention design and implementation. We designed curriculum activities to account for a wide variety of personal, behavioral, and environmental factors that were considered to influence screen media use among children. We took great care to make all elements of the curriculum consistent with the cognitive social learning model, particularly concentrating on the four key processes of attention, retention, production, and motivation. As a result, the successful behavior change observed in this study is further evidence of the applicability of social cognitive theory to developing interventions to promote individual and group behavior change (Bandura, 1986, 1997). However, although this study was a successful test of applying social cognitive theory to change a complex behavior in a real-world setting, and thus adds support to the usefulness of this model to explain human behavior, the study was not designed to test a specific part of the model, or contrast the relative importance of different inputs or processes specified by the model. Instead, we have provided a description of how we applied the principles of social cognitive theory to the specific behavior-change activities that comprised the curriculum and their implementation. These can now serve as examples for developing other theory-based interventions to influence screen media–related behaviors, either in the laboratory setting, to further delineate the processes involved in changing these behaviors, or in naturalistic studies, such as ours, to alter or examine the effects of related behaviors. We concur with Agras et al. (1979) about the need to begin with simple, straightforward efficacy trials before moving to more complicated component studies.

Another strength of this intervention was that it encouraged the child to take control of his or her media use, without dictating specific content or context rules. With the nonspecific 7-hour per week limit, the intervention attempted to help children (and their family members) learn to be "smart" consumers of screen media, by budgeting and regulating their use of television, videotapes, and video games. This focus was selected because of research on perceived choice and control as factors that increase intrinsic motivation for learning and behavior change (Bandura, 1986; Lepper, 1985).

If the effects of this intervention can be replicated in additional samples and settings, further research might examine which specific aspects of the intervention are necessary to produce effects. Future component studies may also be useful in clarifying how specific elements of the intervention affected outcome expectancies and perceived self-efficacy for each of the specific behaviors targeted. This intervention involved only a small sample of northern California third- and fourth-graders. It is unknown whether this intervention would produce similar effects in schools in other geographic and sociodemographic settings. We designed the intervention and curriculum components to be "age appropriate," and because some of the specific factors influencing attention, retention, production, and motivation processes would differ across age groups, we believe that modifications would be necessary before this intervention could be used effectively with other age groups. Last, we delivered this intervention through schools. Other researchers may wish to test whether comparable effects are observed if a similar intervention is delivered through parents.

From clinical, practical, and policy perspectives, this study has produced an efficacious and potentially generalizable, classroom-based curriculum to reduce third and fourth grade children's screen time. The curriculum also reduces television viewing among other household members. Because the intervention was tested in a naturalistic, public elementary school setting and sample, and delivered by the existing classroom teachers, this may be the first feasible and effective response to the many calls from health, education, and child and family advocacy groups to limit children's television viewing. For other investigators, this study provides a model for an ethical and practical experimental method to study the hypothesized impacts of media exposure on children's and families' health, behaviors, and well-being. Instead of studying increased media exposure as a cause of adverse outcomes, the standard approach under the current "problem-oriented" or "disease-oriented" research paradigm, this new experimental model is more consistent with a "solution-oriented" research paradigm, in which one tests the effects of *reducing* the putative risk factor of media exposure as a cause of improved outcomes (Robinson & Sirard, 2005). This approach avoids ethical concerns regarding exposing children to potentially harmful media (e.g., violent, commercial, or obesogenic media content), supports causal inferences because of its experimental design, and also can result in identifying a "solution" that is not possible from the standard approach to etiological research.

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