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## Effect of Visual Media Use on School Performance: A Prospective Study

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## ABSTRACT

**Purpose:** To identify mechanisms for the impact of visual media use on adolescents' school performance.

**Methods:** We conducted a 24-month, four-wave longitudinal telephone study of a national sample of 6,486 youth aged 10-14 years. Exposure Measures: Latent construct for screen exposure time (weekday time spent viewing television/playing videogames, presence of television in bedroom) and variables for movie content (proportion of PG13 and R movies viewed). Outcome Measure: Self and parent reports of grades in school. Effects of media exposures on change in school performance between baseline and 24 months were assessed using structural equation modeling. Information about hypothesized mediators (substance use, sensation-seeking, and school problem behavior) was obtained at baseline and at the 16-month follow-up.

**Results:** Adjusted for baseline school performance, baseline levels of mediators, and a range of covariates, both screen exposure time and media content had adverse effects on change in school performance. Screen exposure had an indirect effect on poor

school performance through increased sensation-seeking. Viewing more PG-13 and R-rated movies had indirect effects on poor school performance mediated through increases in substance use and sensation-seeking. R-rated viewing also had an indirect effect on poor school performance through increased school behavior problems. The effect sizes of exposure time and content on the intermediate variables and ultimately on school performance were similar to those for previously recognized determinants of these mediators – including household income, parenting style, and adolescents' self-control.

**Conclusions:** These aspects of visual media use adversely affect school performance by increasing sensation-seeking, substance use and school problem behavior.

Key words: visual media; sensation-seeking; school performance; mediation; screen time; screen exposure; media content

## INTRODUCTION

To the extent that school performance predicts educational attainment, it has the potential to affect a host of economic and health outcomes. The relation between television and movie viewing and school performance has been a subject of debate. Studies on preteens and adolescents have suggested a detrimental effect of television viewing on school performance (1-3) relating it to lower homework completion, more learning problems, and worse academic achievement. However, little is known about what exactly it is about viewing television that affects school performance. For example, is it simply that time spent watching television displaces time doing homework, or does media use influence behavioral characteristics that are ultimately related to school performance? In a cross-sectional study, we found that hours of weekday television viewing and viewing of R-rated movie content were associated concurrently with poor school performance.(4) These observed effects for media exposure could involve intermediate processes and need to be tested in prospective research designs. In this paper we report results from a longitudinal analysis that tested several hypothesized pathways linking media variables to change in school performance.

## Theoretical Model

We have developed a heuristic model, based on social-cognitive theory, that suggests several pathways through which visual media exposure can affect school performance (Figure 1). First, time spent on media use could simply displace time spent doing other activities that promote academic performance, such as doing homework or reading books. Second, viewing certain types of adult content could affect school performance by increasing adolescents' involvement in risky behaviors, such as smoking and alcohol use, resulting in decreased motivation at school. Indeed, exposure to such cues in television or movies increases involvement by adolescents in cigarette smoking(5-12), alcohol use(13-17), and sex(18-20). Third, there are certain dispositions that predict poor school performance, particularly a preference for intense and exciting sensations, which has been termed sensation-seeking.(21-26). Frequent viewing of movies that contain high levels of excitement and arousal (e.g., "action" movies) could increase the desire for these kinds of experiences, which is behaviorally incompatible with concentrated effort on reading and writing. There is also evidence to suggest that exposure to media violence promotes aggressive and uncontrolled behaviors.(27-31) When such behaviors occur in school (e.g., fighting with other students and arguing with teachers) they would be detrimental to the classroom environment and the student's relationship with teachers and other school personnel.(32) While we could not test all possible pathways shown in Figure 1, in the present research we explored three indirect pathways between visual media exposure and school performance and also tested for possible direct effects of media variables on school performance. We used a prospective analysis with structural equation modeling,

including baseline measures of each of the three intermediate variables (substance use, school problem behavior, and sensation-seeking). Hence, we could test the effect of television and movie viewing on changes over time in these hypothesized intermediate variables, and subsequent effects of the intermediate variables on change in school performance. The model included baseline covariates, variables likely to be correlated with both media exposure and school performance, so as to address potential alternative explanations for the observed effects of media exposure on school performance.

## METHODS

### Design/Setting/Participants

A national sample of U.S. youth aged 10-14 years was recruited between June and October 2003 through a random digit dial telephone survey. Details on the recruitment methods have been published previously.(33;34) Trained interviewers administered the survey. To ensure privacy, a Westat (Rockville, MD) computer-assisted telephone interview system was used so that adolescents could respond to sensitive questions by pressing numbers on the telephone keypad rather than speaking them out loud. Of 9,849 eligible households, parents in 7,492(77%) families consented, and in these families, 6,522(87%) adolescents assented to participation. After the baseline interview (Time 1), participants were interviewed again with follow-ups at 8 months (Time 2), 16 months (Time 3), and 24 months after baseline (Time 4). The study was approved by the institutional review boards of Dartmouth Medical School and Westat, and a Certificate of Confidentiality protecting the data was obtained from NIH.

### Main Outcome Measure

We used a 3-item construct to measure school performance at Time 4 assessment. The youth were asked two questions, “How well do you usually do in school?” (Excellent, Good, Average, Below Average), and “What grades do you normally get?” (Mix of A’s and B’s, Mostly B’s, Mix of B’s and C’s, Mostly C’s, Mostly D’s and F’s). The parents were asked, “How well does your child usually do in school?” (Excellent, Good, Average, Below Average). A composite measure for Time 4 school performance had a Cronbach alpha of 0.84. The first question was also asked at Time

1, and this item was included in the analysis to provide a baseline measure for school performance. In both cases, a higher score indicates worse school performance.

### Measures of Media Exposure

The baseline interview included questions to measure both the time spent using media and the content viewed (Table 1). A latent construct for screen exposure was based on two questions about television and videogame exposure on school days, plus a query about whether the adolescent had a TV in the bedroom. For this measure and other measures described subsequently, a higher score indicates more of the named construct.

To measure content aspects, participants were presented with lists of 50 movie titles randomly drawn from a pool of 532 popular contemporary movies (each adolescent responded to a unique list of 50 titles). Movies in the individual lists were stratified by Motion Picture Association of America (MPAA) rating so that all lists had a similar MPAA rating distribution (20% G/PG, 40% PG-13, 40% R) reflecting the general availability of movies at the box office during the time of the study. For each participant we calculated the proportion of the movies he/she had viewed that were PG-13 rated and the proportion that were R-rated. Data on venue indicated that 8% of the participants viewed movies primarily in theaters, 51% viewed them primarily through videotape or DVD, and 41% primarily viewed movies through television including cable and pay per view, so television programming was an important venue for movie exposure but not the primary one.

## Covariates and Mediators

Our heuristic model (Figure 1) lists a variety of factors that may be correlated with television viewing and school performance but are not assumed to be involved in transmitting the effect of media exposures (covariates). The model includes three constructs that are hypothesized to represent intermediate processes in the relation between media exposure and school performance (mediators), with paths hypothesized from these mediators to the outcome construct of poor school performance.

### Covariates

The covariates constituted three general classes of variables: parenting style, adolescents' self-control characteristics and extracurricular activities, and demographics. The specific questions asked to measure these variables, their response categories, and reliability coefficients for the scores used are listed in Table 1. We used two validated measures of parenting style that assess authoritative parenting (maternal responsiveness and monitoring) (35). Self-control was measured by responses to four questions about whether the adolescent delays gratification versus being disinhibited and distractible. Engagement in extracurricular activities was measured with six questions about participation in organized and unorganized sports, clubs, and activities. Demographic variables were assessed by participant report for age, gender, race, and family structure, and by parent report for parental education and household income.

### Mediators

The measures for the mediator variables are also listed in Table 1. For sensation-seeking disposition we used a 4-item scale, a subset of questions from the Zuckerman inventory. Problem behavior in school was assessed with four questions that measured the frequency of arguing, fighting, and disobedience. To measure substance use, we asked whether the participant had ever tried cigarettes or alcohol. All mediator variables were measured at both Time 1 and Time 3, so we could test for change in the intermediates as a function of media exposure variables at Time 1.

### Statistical analysis

First we tested the association between each covariate and the Time 1 media use variables, and then we tested the association between each covariate and school performance at 24 months. Chi-square analysis was used for categorical variables, analysis of variance was used to compare means among groups, and Spearman correlations were used for ordinal variables.

Structural equation modeling analysis [SEM] tested whether media variables at Time 1 are related to school performance at Time 4 through influencing intermediate processes (mediators) between Time 1 and Time 3. The theoretical predictor variables at Time 1 were a latent construct for screen exposure (based on three indicators) and scores for the proportion of the movies a person had viewed that were PG13 rated and the proportion that were R rated. These predictors were specified as being correlated with demographic variables (age, gender, race, family structure, education, and household income), mother's responsiveness and monitoring, adolescent's self-control and engagement in extracurricular activities, and parental smoking [sum of mother's

and father's smoking status]. Baseline values were included for adolescent's substance use [sum of ever used cigarettes and ever used alcohol], sensation-seeking, and school problem behavior. Time 1 school performance was included so as to index change in school performance between Time 1 and Time 4 as a function of the model variables.

The structural model was specified with Time 1 media measures, the covariates, and baseline measures of the mediators as exogenous (i.e., not predicted by any prior construct in the model); correlations among all the exogenous variables were included in the model. Hypothesized intermediates measured at Time 3 were specified as endogenous (i.e., could be predicted by prior constructs in the model) and correlations among the residual terms for these constructs were included. The outcome was a latent construct for poor school performance at Time 4, based on three indicators as described previously.

The model was analyzed in Mplus version 4(36) using maximum likelihood estimation with robust estimates of standard errors; the EM algorithm was employed to model missing data. From the baseline sample of 6,522, participants who reported zero movie exposure at Time 1 ( $n = 36$ ) were excluded from the analysis because proportion scores for movie exposure could not be computed; hence, the analysis sample size was 6,486. The fit of the model to the data was indexed with the chi-square statistic, the Comparative Fit Index (CFI), and the Root Mean Square Error of Approximation (RMSEA). An initial model was estimated with all paths from Time 1 variables to Time 3 constructs, and all paths from Time 3 constructs to the Time 4 school performance outcome. Several non-significant paths were eliminated from the initial model and additional coefficients were included on the basis of modification indices, including two

correlated error terms among indicators for the latent constructs. For the final model, we retained variables having path coefficients that were significant at  $p < 0.01$  with robust estimates.

## RESULTS

The interviewed sample was 6,486 at Time 1, 4,995 at Time 3, and 4533 at Time 4. At Time 1, the mean age of youth was 12 (range 10-14); 62% were White, 18% Hispanic, 11% Black, and 9% were Other race. Overall, 31% had a parent with a college degree, and household income ranged from \$10,000 or less (8%) to over \$75,000 (30%). Analyses of attrition showed that persons who dropped out of the study were somewhat more likely to be of nonwhite race and lower socioeconomic status, and to score higher on rebelliousness and sensation-seeking.(37) Detailed multivariate analyses of attrition effects showed that the set of study variables accounted for 3-5% of the variance in attrition, so overall the magnitude of attrition effects was moderate and the composition of the continuing sample was similar to that of the baseline sample.

Descriptive data showed that participants reported the following grades for baseline school performance: “excellent” (30%), “good” (42%), “average”/“below average” (28%). There were significant correlations at baseline between the covariates and the media use variables at Time 1 (Table 2). For example as compared to youth with better grades, participants with Average/Below average grades were more likely to have a television in the bedroom, to have more hours of television viewing and video game playing, and to watch a higher proportion of movies that were PG-13 or R-rated; and participants with greater screen exposure and more PG13/R movie viewing scored higher on sensation seeking and school problem behavior. For intermediate variables, the proportion of participants who had ever smoked (even a puff) increased from 10% at Time 1 to 18% at Time 3, and the proportion who had ever drunk alcohol increased from

10% to 19%. The mean score for sensation-seeking increased from 7.9 at Time 1 to 8.3 at Time 3, and the mean score for school problem behavior increased from 2.41 at Time 1 to 2.50 at Time 3. At Time 4, participants reported the following grades: “A’s & B’s” :61%; “Mostly B’s” :12%; “B’s & C’s”: 20%; “Mostly C’s” :6%; “Mostly D’s & F’s”:1%. Table 3 shows the relationship between baseline covariates and school performance at Time 4.

The final structural model (Figure 2) had chi-square (127 df,  $N = 6,486$ ) of 1021.50, CFI of 0.92, and RMSEA of 0.033, these parameters generally indicating reasonable fit of the model to the data. Extracurricular activities and parental smoking were nonsignificant and were dropped from the initial model. The residual correlations of Time 3 variables (excluded from the figure for graphical simplicity) were 0.09 between substance use and school problem behavior, 0.16 between school problem behavior and sensation-seeking, and 0.10 between sensation-seeking and substance use. Hypothesized paths from the Time 3 intermediates to Time 4 school performance were all significant (beta = .06 for substance use, beta = .14 for school problem behavior, and beta = .12 for sensation seeking), thus qualifying these as mediating variables. A direct effect from Time 1 screen exposure to poor school performance at Time 4 (beta = .07,  $t = 1.80$ ,  $p < .10$ ) was omitted from the figure because it did not meet the criterion for statistical significance; a path from poor school performance at Time 1 to substance use at Time 3 (beta = .05,  $t = 4.45$ ,  $p < .0001$ ) was omitted from the figure for graphical simplicity. The prior variables in the model accounted for 20% to 40% of the variance in the hypothesized mediators. Together the variables in the model, including direct

effects, indirect pathways, and the stability coefficient for school performance, accounted for 48% of the variance in Time 4 school performance.

The coefficients in Figure 2 are standardized to make them comparable; they indicate the change in school performance expected for a 1 standard deviation increase in the predictor, adjusted for all other covariates. Regarding hypothesized pathways, there was a significant indirect effect from more Time 1 screen exposure to worsened school performance at Time 4 through an increase in sensation-seeking at Time 3. Also, Time 1 PG-13 movie viewing had indirect effects for worsened school performance at Time 4 through two mediating variables, increased substance use and increased sensation-seeking at Time 3. The Time 1 measure for R movie viewing had indirect effects on worsened school performance through changes in all three mediators from Time 1 to Time 3: increases in substance use, sensation-seeking, and school problem behavior.

With regard to the effects of other Time 1 variables on school performance, maternal responsiveness and monitoring resulted in better school performance because they decreased school problem behavior and substance use, respectively. In addition to a direct effect for (better) school performance, good self-control also improved school performance because it was related to a decrease in sensation-seeking. Sensation-seeking itself was a key predictor variable aside from the role as an intermediate variable for media effects: initial sensation-seeking led to worsened school performance through effects on higher levels of substance use and school problem behavior at Time 3. In addition to the stability coefficient for school performance from Time 1 to Time 4, poor school performance at Time 1 affected subsequent school performance through its

links to increases over time in school problem behavior, sensation-seeking, and substance use.

Effects for Time 1 demographic variables, included in the model but excluded from the figure for graphical simplicity, were as follows. Positive relations to change in substance use were noted for older age (beta = 0.14,  $p < 0.0001$ ), female gender (beta = 0.05,  $p < 0.001$ ) and White race (beta = 0.06,  $p < 0.001$ ). Inverse relations to change in school problem behavior from Time 1 to Time 3 were noted for female gender (beta = -0.04,  $p < 0.01$ ) and household income (beta = -0.07,  $p < 0.0001$ ). Change in sensation-seeking was positively associated with White race (beta = 0.07,  $p < 0.0001$ ) and was inversely associated with household income (beta = -0.04,  $p < 0.01$ ). Female gender (beta = -0.09,  $p < 0.0001$ ), White race (beta = -0.06,  $p < 0.01$ ), higher household income (beta = -0.06,  $p < 0.01$ ), and higher parental education (beta = -0.08,  $p < 0.0001$ ) were all inversely related to worse school performance.

## DISCUSSION

Using a longitudinal study design, we found a detrimental effect of visual media use on school performance. We tested three mechanisms for the relation between media use and worsened school performance, through effects of media variables on adolescents' substance use, school problem behavior, and disposition for sensation-seeking. Each of these variables showed change over the study period, and a structural equation modeling analysis showed that both time spent with television/videogames and specific content in movies viewed (PG13 and R ratings) influenced change in school performance through affecting the hypothesized mediators.

After controlling for associations with covariates, the coefficients for the effects of media variables on intermediate processes and ultimately on school performance are similar to those for parenting style (maternal responsiveness and monitoring) and adolescent's self-control. The latter finding is noteworthy because self-control has been shown to have an effect on academic performance similar to that observed for IQ (22). The effect sizes for media variables in the present study suggest that the environmental influence of media exposure may have an effect comparable to that of variables recognized as important determinants of school performance, including demographics (e.g., parental education and income), parenting styles, and self-control characteristics.

The paths shown in Figure 2 are consistent with the concept that both quantity of screen exposure and characteristics of media content affect school performance. Amount of screen exposure had an indirect effect through increased sensation-seeking and possibly through a direct effect on school performance consistent with the displacement hypothesis, though the latter effect was only marginally significant. Supporting predictions from our heuristic model, the content variables (PG-13 movie viewing and R-movie viewing) acted on school performance through indirect effects; results showed R-rated movie viewing had the most diverse effects, having paths to all three mediators, but PG13 viewing also had indirect effects through two of the mediators. Thus the results provide more support for media effects operating through behavioral processes, as evidenced by the changes over time in the intermediate variables (sensation-seeking, substance use, and school problem behavior). However, variables germane to alternative hypotheses, such as measures of homework completion or motivation for academics, were not included in the present study and

could be assessed in more detail in further research. The results also showed that some of the study variables (e.g., self-control, sensation seeking) had direct or indirect effects on school performance themselves, and these should be considered for inclusion in further studies of academic performance.

While the study had a longitudinal design, control for baseline school performance, and adjustment for other important predictors of school performance, it has some limitations. The measures were brief ones, some of relatively low reliability; more extensive scales and multiple indicators for all constructs would enhance measurement reliability in further research. A possible mediator, time spent sleeping, has been shown in other studies to be an inverse correlate of time spent viewing television and playing videogames (38;39), but was not measured here. Assessment of academic performance through different sources and methods (e.g., school grades, standardized tests) would be desirable where this is feasible. Finally, we did not specifically identify the type of PG-13 or R-rated content in television and movies (violence, sexual behavior, language, etc) that influenced adolescent problem behavior. Including specific content and mediator variables would help clarify how media effects on adolescent behavior occur.

In summary, the present findings are consistent with related research on the deleterious effects of media use on school performance. The new information about the mechanisms through which these effects occur can aid in educational interventions targeting parents. This work provides specific counseling points as to the risks of both quantity and content of media use and their relations to adolescent behaviors and dispositions that can lead to worsening school performance. The results may also be

useful through delineating multiple pathways from media exposure to academic outcomes, which can be addressed in media literacy programs.(40;41) Overall, the findings offer strong evidence for parental monitoring of children's television viewing time and, especially, restricting exposure to adult movie content during early adolescence.

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Figure 1: Theoretical relationships between media use, intermediate variables, and school performance

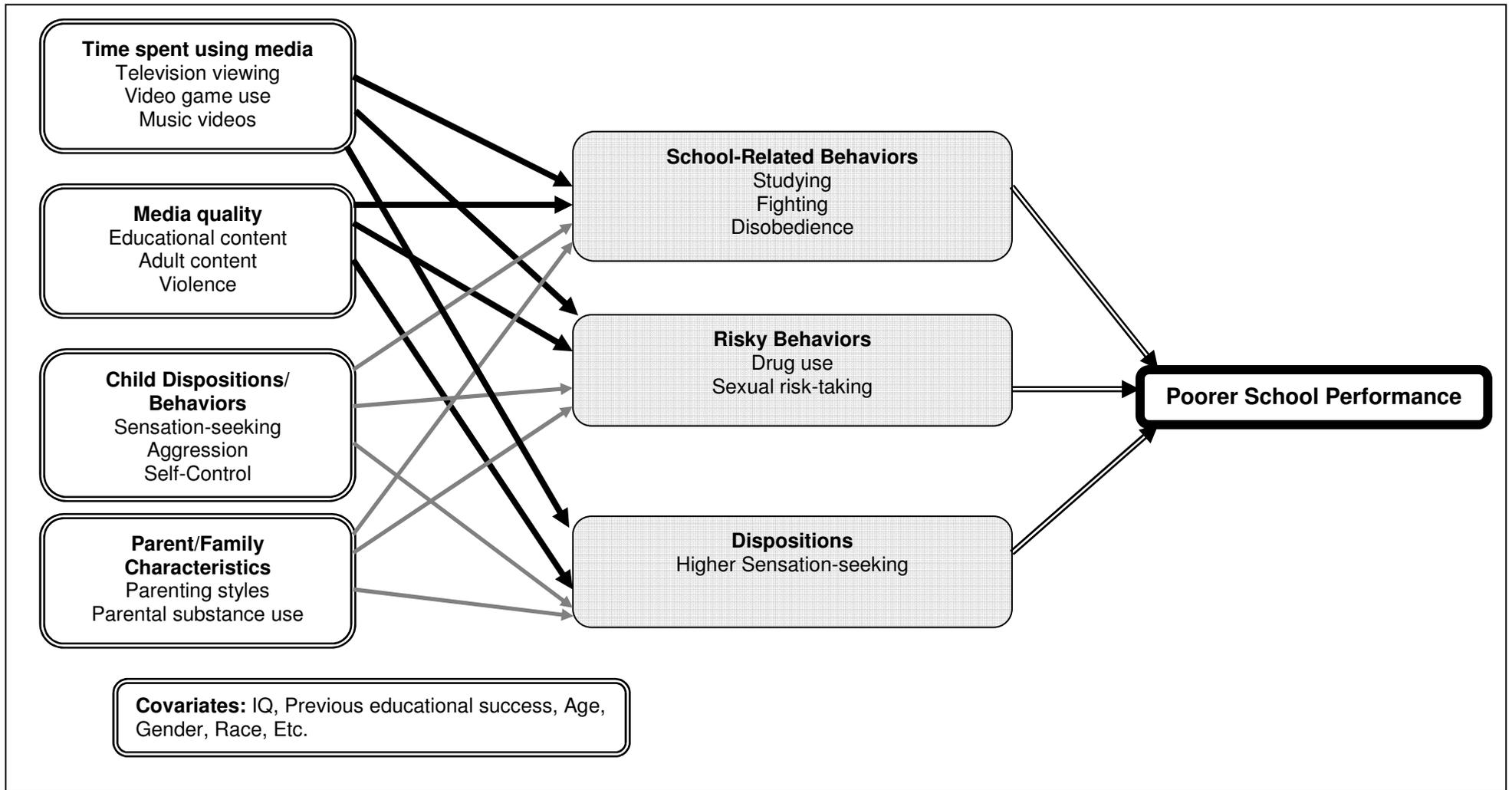


Figure represents possible mechanisms relating media use and school performance over time, based on social cognitive theory. Relationships shown are not meant to cover all possible relationships, but those which have some support in the literature.

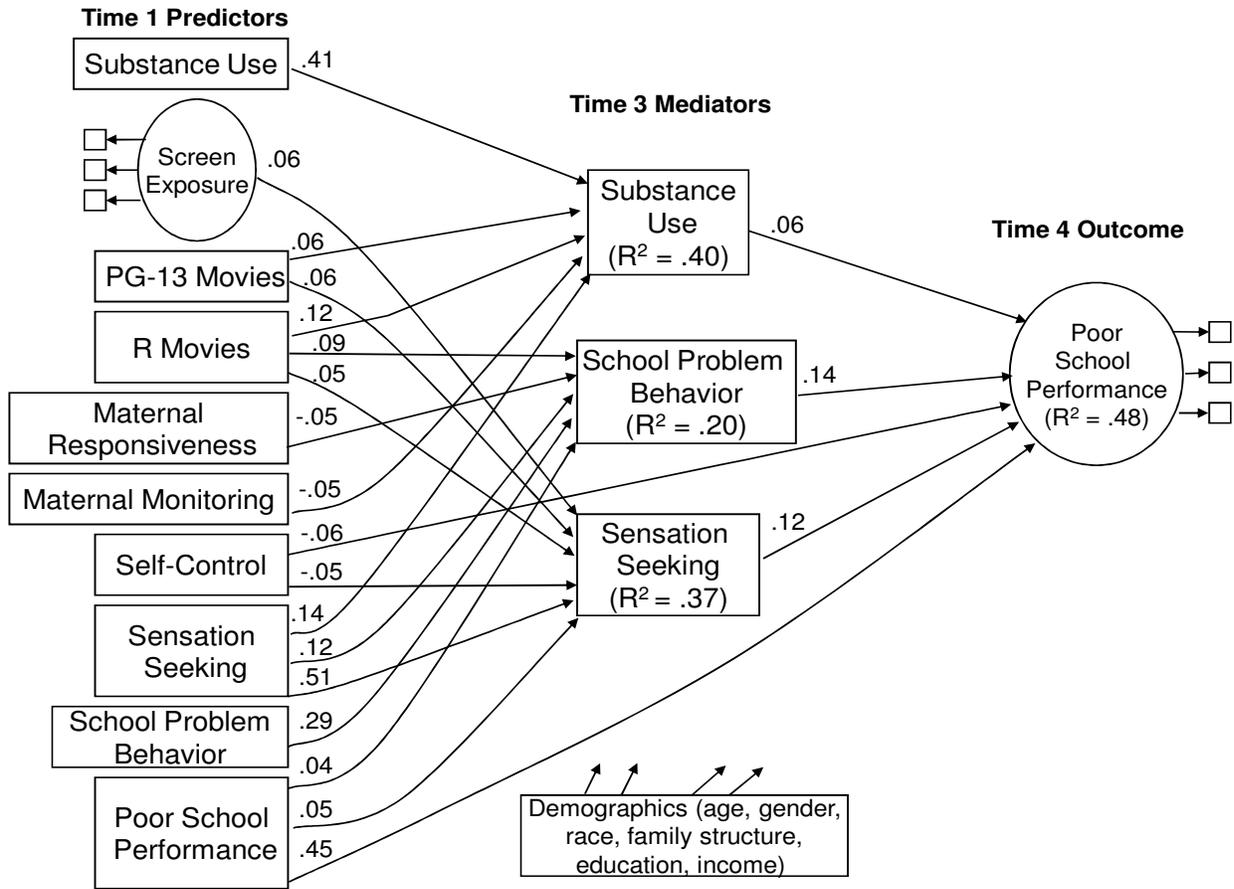


Figure 2. Structural model for relation of Time 1 predictors and Time 3 mediators to Time 4 school performance. Analytic N=6,486. Ovals indicate latent constructs, rectangles indicate manifest variables. Values are standardized coefficients; all coefficients are significant at  $p < .01$ . For correlations of exogenous variables, residual correlations of Time 3 variables, and two paths for Time 1 variables, included in the model but omitted from the figure for graphical simplicity, see Table 2 and text. Values included with endogenous variables are squared multiple correlations, the variance accounted for in a given construct by all variables to the left of it in the model.

Table 1. Description of questions used to measure media variables, parenting style variables, and adolescents' disposition & behavior variables

Variable	Survey questions	Response categories
<b>Media Predictors</b>		
Weekday television viewing	On school days, how many hours a day do you watch TV? (Include the time you spend watching TV or movies on video, but NOT time you spend playing video games)	None Less than one hour One to three hours, Four to seven hours, Eight or more hours
Weekday videogames	On school days, how many hours a day do you play video games?	None Less than one hour One to three hours, Four to seven hours, Eight or more hours
TV in the bedroom	Do you have a television in your bedroom?	No Yes
Proportion PG-13 movies	Have you seen <Title>?	No Yes
Proportion R-rated movies	Have you seen <Title>?	No Yes
<b>Covariates measured at Time 1</b>		
Maternal Responsiveness 5-item index range: 5-20 Cronbach's alpha = 0.75	She is pleased with how I behave She likes me just the way I am She listens to what I have to say She makes me feel better when I am upset She wants to hear about my problems	Not like her Sort of like her A lot like her Just like her
Maternal Monitoring 4-item index range: 0-12 Cronbach's alpha = 0.60	She knows where I am after school She has rules about how I spend my time after school She asks me what I do at my friends' houses She checks to see if I do my homework She usually lets me get away with breaking the rules She makes sure I go to bed on time	Not like her Sort of like her A lot like her Just like her
Adolescent's Self-control 4-item index Range: 4-16 Cronbach's alpha = 0.41	I am good at waiting my turn.  I get my homework done first so I can have fun later.  I bother other students when they are trying to work.  I have to be reminded several times to do things.	Not like you A little like you A lot like you Just like you
Engagement in extracurricular activities  Sum of responses to 6 questions Range: 0-24	How often do you participate in team sports where there is a coach? [for example, football, baseball, basketball or soccer]  How often do you participate in other sports without a coach? [for example, pick-up basketball, or skiing with your friends or family.]	Never One - few times a month One - few times a week Almost every day

	<p>How often do you attend church or other religious activities?</p> <p>How often do you go to music lessons, choir, dance, or band practice?</p> <p>How often do you participate in school clubs or activities like math or science clubs or the school paper?</p> <p>How often do you participate in other clubs like the Boy or Girl Scouts, 4-H, or the Boys or Girls Clubs of America?</p>	
<b>Mediators: measured at Time 1 and Time 3</b>		
<p>Sensation Seeking 4-item index range: 4-16 Cronbach's alpha = 0.59</p>	<p>I like to do scary things. I like to do dangerous things. I often think there is nothing to do. I like to listen to loud music.</p>	<p>Not like you A little like you A lot like you Just like you</p>
<p>School problem behaviors Sum of responses to 4 questions</p>	<p>During the past month, how many times were you sent to the school office because of fighting?</p> <p>In the past year, did you cut or skip any classes without permission?</p> <p>Please tell me how well each of the following statements describes you: I do what my teachers tell me to do I argue with teachers</p>	<p>Never Once Twice Three or more times</p> <p>No Yes</p> <p>Not like you A little like you A lot like you Just like you</p>
<p>Tried smoking</p>	<p>Have you ever tried smoking a cigarette, even just a puff?</p>	<p>No Yes</p>
<p>Tried alcohol</p>	<p>The next few questions are about alcohol. By alcohol, we mean beer, wine, wine coolers or liquor, like vodka or gin.</p> <p>Have you ever drunk alcohol that your parents did not know about?</p>	<p>No Yes</p>

Table 2: Relationship between media use and other variables at baseline

	% subjects viewing > 2hrs TV on weekdays	% subjects playing videogames > 1hr on weekdays	% subjects with TV in bedroom	Mean % PG-13 movies viewed for all subjects	Mean % R-movies viewed for all subjects
<b>Parent/family characteristics</b>					
Parental education					
• High school	33%	34%	71%	41% $p=0.20$	20%
• Some college	31%	35%	64%	42%	17%
• Bachelor's degree	21%	30%	44%	41%	12%
Parenting practices					
• Maternal responsiveness	-0.09	-0.08	-0.05 $p=0.0002$	-0.05	-0.22
• Maternal monitoring	-0.09	-0.06	-0.01 $p=0.26$	-0.09	-0.18
Family structure					
• Lives with both parents	25%	32%	55%	41% $p=0.003$	14%
• Doesn't	36%	36%	72%	43%	21%
Income					
• \$10,000 or less	38%	33%	73%	39%	23%
• \$10,001-20,000	35%	34%	71%	39%	22%
• \$20,001-30,000	37%	38%	66%	42%	20%
• \$30,001-50,000	29%	35%	65%	42%	17%
• \$50,001-75,000	27%	36%	59%	42%	15%
• >\$75,000	22%	28%	49%	43%	13%
<b>Baseline adolescent disposition/behavior</b>					
Sensation-seeking	0.14	0.15	0.12	0.15	0.36
School problem behavior	0.09	0.11	0.09	0.04 $p=0.001$	0.27
Self control	-0.17	-0.15	-0.02 $p=0.06$	-0.06	-0.17
Extracurricular activities	-0.13	-0.04 $p=0.002$	-0.08	-0.02 $p=0.05$	-0.11

Other covariates					
Age					
• 10 years	23%	30% <sup>p=0.05</sup>	57%	34%	11%
• 11 years	27%	32%	58%	37%	12%
• 12 years	32%	35%	60%	42%	16%
• 13 years	29%	35%	62%	46%	19%
• 14 years	31%	34%	66%	48%	24%
Gender					
• Female	27%	21%	56%	42% <sup>p=0.007</sup>	14%
• Male	30%	45%	65%	41%	19%
Race					
• White	24%	34%	56%	42% <sup>p=0.41</sup>	14%
• Non-white	37%	33%	68%	42%	20%
Baseline school performance					
• Excellent	22%	27%	54%	40%	13%
• Good	28%	24%	60%	42%	16%
• Average/Below	37%	39%	68%	43%	22%

Unless otherwise indicated, all relationships shown are statistically significant with a p value <0.0001. Chi-square was used to test the relationship between dichotomous media variables (viewing > 2 hrs TV, playing > 1hr videogames, TV in bedroom) and categorical variables (parental education, income, age, gender, race, school performance). ANOVA was used to compare means (for % PG-13 movies and % R-movies viewed) across groups; Spearman's rho was used to test the relationship between ordinal variables (parenting style and disposition/behavior variables) with the media variables. For certain variables (parental education, income, age) we display percentages from chi-square analysis rather than Spearman correlations because the specific numbers for the media variables provide additional descriptive detail.

Table 3: Relationship between baseline variables and poor school performance at 24 months.

	School performance at 24 months
<b>Parent/family characteristics</b>	
Parental education	-0.25
<b>Parenting practices</b>	
• Maternal responsiveness	-0.24
• Maternal monitoring	-0.13
Lives with both parents	-0.17
Household income	-0.24
<b>Media use</b>	
Hours of weekday TV viewing	0.13
Hours of weekday video game playing	0.10
TV in bedroom	0.15
% PG-13 movies	0.05
% R-movies	0.27
<b>Personality/temperament</b>	
• Sensation-seeking	0.22
• School problem behavior	0.22
• Self-control	-0.29
• Extracurricular activities	-0.18
<b>Other covariates</b>	
Age	0.08
Male gender	0.21
Nonwhite race	0.15
Baseline school performance	0.54

Spearman's rho used to compare relationship between baseline variables and school performance at 24 months.  
 All  $p < 0.0001$ , except for % pg-13 movies ( $p = 0.0002$ )