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Relations Between Daily Activities and Adolescent Mood: The Role of Autonomy

Sally M. Weinstein and Robin Mermelstein

Institute for Health Research and Policy and Department of Psychology, University of Illinois at Chicago

Abstract

This study explored the combined influences of daily activities and autonomy in activity engagement on adolescent daily positive and negative moods. Ecological momentary assessments (*EMA*) were used to obtain information about 8th- and 10th-grade students' ($N = 517$) mood, activities, and situation throughout the day. Participants responded to random prompts on the *EMA* device and, when prompted, rated mood adjectives and reported on their current activity and perceived autonomy in activity engagement. Mixed-effects regression models examined changes in mood across specific activity categories. Positive mood significantly improved when engaging in numerous activities; negative mood improved during social activities as well as “party” and “hanging out” events but was fairly consistent across other activities. Stronger mood–activity relations were found after controlling for autonomy in activity engagement.

Adolescence is a time of high risk for the emergence of mood disorders, particularly for girls (Angold, Costello, & Worthman, 1998; Angold, Erkanli, Silberg, Eaves, & Costello, 2002; Hankin et al., 1998; for a review, see Twenge & Nolen-Hoeksema, 2002). Despite the documented rise in emotional difficulties during adolescence (Arnett, 1999), the sources of daily changes in mood are less understood. Daily fluctuations in adolescent well-being may well be related to the types of activities in which adolescents engage. In addition, autonomy-enhancing factors in adolescent day-to-day experience, such as the subjective value of daily activities and level of personal choice in activity engagement, may contribute to daily mood. The goal of this study was to examine how perceptions of autonomy in activity engagement, assessed via real-time data capture (ecological momentary assessment [*EMA*]), influence daily positive and negative affect among 8th- and 10th-grade adolescents.

Daily Activities and Mood

A considerable body of research highlights daily events and activities as important contextual determinants of daily mood and emotional well-being. Early work, grounded in behavioral theories of adult depression, established that the occurrence of negative events was associated with dysphoria, whereas pleasant events and activities predicted improvements in mood (Grosscup & Lewinsohn, 1980; Lewinsohn & Amenson, 1978; Lewinsohn & Graf, 1973; Lewinsohn & Libet, 1972). More recent research has focused on the day-to-day relations among specific activities and adult mood, with findings generally indicating that positive and negative moods are differentially related to events. For example, a consistently robust link has been found between daily positive mood and social events (e.g., parties, leisure time with friends and family, social eating and drinking events; Clark & Watson, 1988; David, Green, Martin, & Suls, 1997; Watson, Clark, McIntyre, & Hamaker, 1992), suggesting that individuals

experience greater positive affect when engaging in social activity. In contrast, daily changes in negative affect are predicted by undesirable work events (David et al., 1997) and negative social interactions (Clark & Watson, 1988). Moreover, time-lagged analyses suggest that events significantly predict mood rather than the reverse (Nezlek & Gable, 2001).

Acknowledgment of person–situation interactions (Endler & Magnusson, 1976) suggests that the influence of events on mood may be moderated by individual-level factors. Accordingly, evidence indicates that day-to-day event–mood relations vary as a function of individual differences in personality and behavioral motivation systems (Gable, Reis, & Elliot, 2000) and depressive symptoms (Nezlek & Gable, 2001). Thus, the mood-related effects of activities may also depend on relevant factors within the person; to focus solely on the main effects may ignore the personal context in which these factors operate.

Relatively fewer studies have examined event–mood relations among youth, but evidence points to the importance of these situational influences on child and adolescent mood. Research examining child and adolescent depressive symptoms reveal similar negative event–mood links as seen with adults (Carey, Kelley, Buss, & Scott, 1986; Larson & Ham, 1993; Swearingen & Cohen, 1985; Wierzbecki & Sayler, 1991). In addition, adolescents report better mood during social versus solitary activities (Larson, 1990). Moreover, organized group activities are associated with positive youth development (Hansen, Larson, & Dworkin, 2003).

However, child and adolescent research has also generated questions regarding the impact of activities on well-being. Contrary to the adult literature, studies of youth generally report weak and inconsistent effects for positive event–mood relations (Carey et al., 1986; Swearingen & Cohen, 1985; Wierzbecki & Sayler, 1991). Additional research is needed to clarify the nature of mood-related activities in youth, particularly work that incorporates relevant person-level variables. Children and adolescents are likely to have less control over their activity engagement than adults. Thus, weak effects for pleasant activities may be attributable to such activities being chosen by others versus self-selected and, hence, less rewarding (Wierzbecki & Sayler, 1991). To extend previous research, this study included measures of choice and importance of activity engagement in the investigation of activity–mood relations.

Personal Choice and Well-Being: Autonomous Activities in Adolescence

Issues of choice and value in activity engagement are central to understanding the emotional experiences of adolescents. The search for autonomy is a salient developmental task in adolescence (Cicchetti & Rogosch, 2002). Moreover, self-determination theory posits that autonomy, defined as the perception that one's activities are self-chosen and self-endorsed, is one of three basic needs essential for psychological growth across the lifespan (Deci & Ryan, 1985). Following from this, activities that are perceived as high in personal choice and value are expected to facilitate autonomy and thus enhance well-being, whereas activities that detract from autonomy would have negative effects on mood (Reis, Sheldon, Gable, Roscoe, & Ryan, 2000).

Research conducted within this framework supports the relation between self-chosen activities and adult well-being. Sheldon, Ryan, and Reis (1996) and Reis et al. (2000) used daily diary methods to examine whether activities contributing to the attainment of autonomy influenced change in well-being among college students. Results indicated that higher levels of daily autonomy predicted increases in positive affect and decreases in negative affect. Yet few studies have examined the influences of autonomy satisfaction in daily activities on child and adolescent well-being. Véronneau, Koestner, and Abela (2005) found that the satisfaction of autonomy predicted current levels of positive and negative moods among third and seventh graders. Additionally, related experimental research with children has demonstrated that the perception or provision of choice in a task yields greater outcomes than forced-choice tasks,

including task performance, engagement, and enjoyment (Deci & Ryan, 1985; Iyengar & Lepper, 1999; Swann & Pittman, 1977). Taken together, findings suggest that fulfillment of autonomy via self-chosen activities promotes well-being in adults and youth.

This Study

Theory and research suggest that daily activities, particularly whether activities are perceived as self-chosen and important, impact adolescent well-being. The goal of this study was to explore the associations of daily activities and adolescent positive and negative moods while incorporating the role of autonomy—operationalized as the choice and importance of activity engagement—in the investigation of these activity–mood relations. Using EMAs (Stone & Shiffman, 1994), this study addressed the following questions: (a) What activities trigger positive and negative moods? (b) To what extent is the event–mood relation influenced by the perceptions of autonomy in activity engagement?

This study extends the literature by integrating two approaches—the study of activity or event occurrence and the study of autonomy satisfaction—to understand daily emotional experience among adolescents. We examined mood and situations in the moment via EMA, thus reducing the impact of recall difficulties on retrospective reports of activities and mood (Stone & Shiffman, 1994). Experience sampling techniques have been used effectively in previous studies to examine adolescent mood (e.g., Larson, Moneta, Richards, & Wilson, 2002) and activity engagement (Larson, Raffaelli, Richards, Ham, & Jewell, 1990). Moreover, this study examined the differential relations among activities and state affect, whereas prior adolescent research has focused on clinical measures of depressed mood. Much research points to the importance of assessing positive and negative affect as independent dimensions to best capture emotional well-being (e.g., Cacioppo & Gardner, 1999; Clark & Watson, 1988), but less is known about the different contributors to positive and negative mood in adolescents.

It is important to note that the method used did not test causal relations between activity engagement and mood but rather the adolescents' reports of positive and negative moods during activity occurrence. Thus, interpretations regarding the situational influences on mood must be made cautiously. Nonetheless, the simultaneous recording of mood and activity afforded by EMAs extends past daily-events research using retrospective survey methods.

In light of previous research illustrating the affective influences of social activity (e.g., Clark & Watson, 1988; Larson, 1990), we hypothesized that mood would vary by social context: Adolescents would report greater positive affect and lower negative affect when interacting with others as compared to times when alone. In addition, as prior research has revealed sex differences in the importance of social involvement (e.g., Slavin & Rainer, 1990), we hypothesized that social influences on mood would vary by sex. Specifically, we expected that the relations between social activity and moods would be stronger for girls than for boys. Second, we hypothesized that momentary mood assessments would vary across the specific activity categories. As few studies have examined daily activity–mood relations in adolescents, these analyses were largely exploratory. Third, we hypothesized that perceptions of autonomy in activity engagement would influence the relations among specific events and mood, such that the effects of activities on mood would change after adjusting for the choice and importance of activity engagement. Additionally, we expected that overall autonomy in activities across the week would be positively associated with adolescent daily mood. Exploratory analyses also examined whether autonomy predicted another aspect of daily emotional experience, the variability of emotions.

Method

Participants

Data for this study come from a longitudinal study of the natural history of smoking among adolescents. The sample for the longitudinal study was recruited through a multistage process. A screening survey was administered to all 8th and 10th graders at 14 Chicago-area schools ($N = 5,278$); a passive consent was used such that parents and students were notified prior to the screening and given the opportunity to decline their child's participation. Survey responses were used to identify students who had never smoked but were contemplating smoking and students who were experimenting with smoking (defined as youth who smoked less than 100 cigarettes in their lifetime and were not yet daily smokers); 2,153 met inclusion criteria. Of those, a random sample of 1,457 students was invited to participate. Invitation–recruitment packets were mailed to eligible students and their parents. Students were enrolled after written parental consent and student assent were obtained. Of those invited, 713 agreed to participate (48%), and 562 of the 713 (81%) completed the baseline wave. The consent rate is similar to those reported in other EMA and experience sampling studies with adolescents (e.g., Larson et al., 2002; Silk, Steinberg, & Morris, 2003). Failure to complete the baseline assessment was due to (a) students who were absent on the data appointment and were unable to reschedule ($n = 25$, 17%), (b) students did not bring parental consent forms to their appointment ($n = 12$, 8%), or (c) students were turned away by research staff because enrollment in a particular school exceeded the number of palmtop computers available at that school ($n = 114$, 76%). Details regarding the procedures can be found in Diviak, Kohler, O'Keefe, Mermelstein, and Flay (2006).

The sample for this study included 8th- and 10th-grade students who provided EMA data at baseline ($N = 517$). Due to EMA hardware malfunction during the data collection week, approximately 8% of the total sample did not provide EMA data; there were no significant differences on any variables for those who did and did not provide EMA data. Mean age of the participants was 14.36 years ($SD = 1.20$); 56% were girls, and racial=ethnic composition was as follows: 74% White, 5% African American, 13% Hispanic, and 8% other or biracial. Average parental education for the sample was as follows: 30% had completed high school or less, 17% had completed some college, and 45% had completed college or more. The demographic characteristics of the participants enrolled at baseline were representative of the 1,457 students initially invited to participate, although girls and White students were slightly but significantly more willing to participate than boys and non-White students (for details, see Diviak et al., 2006).

Procedure

Participants received training on the use of the EMA device at the beginning of the data collection week and carried the device for 7 consecutive days at each wave. The device randomly prompted the adolescents approximately five to seven times per day; in response to each signal, participants were trained to complete a brief interview about their activity, situation, and mood. Participants received a payment of \$40 at the end of each of the data collection weeks. In addition, self-report psychosocial questionnaires were mailed to the adolescents 2 weeks prior to the data collection week. The participant was instructed to bring the completed questionnaires to his or her EMA training session and were paid \$10 on receipt. All procedures received approval from the Institutional Review Board at the University of Illinois at Chicago.

Measures

Daily affect—Participants were asked on each EMA interview to rate their mood just before the random prompt (e.g., “Before the signal, I felt happy”). Participants responded to mood

adjectives using a 10-point Likert-type scale. The adjectives were selected based on pilot work, including qualitative (focus groups and in-depth interviews) and quantitative data collection with 146 students in Grades 8 through 10 recruited from similar schools to those involved in the study. Confirmatory factor analyses on the sample revealed a Positive Affect (PA) factor (i.e., happy, relaxed, and cheerful) all with factor loadings of at least .74 (Cronbach's $\alpha = .73$). A Negative Affect (NA) factor was formed (i.e., lonely, embarrassed, sad, angry, and left out), all with factor loadings greater than .50 (Cronbach's $\alpha = .73$). The PA and NA scales were significantly but moderately correlated, $r = -.44$, $p < .001$.

Daily activities—Participants were asked to report their current activity each time they were signaled on the EMA device and responded by selecting one or more of the following categories: hanging out, TV/music, computer/game, transit, job, extracurricular activity, schoolwork, physical activity, eating/drinking, resting, telephone, shopping, party, reading (nonschoolwork), nothing, and drug/alcohol use. Descriptions of each category were provided during the EMA training session. Participants were permitted to select all categories relevant to their current activity when prompted, and thus several categories were often simultaneously endorsed during an EMA interview (e.g., selecting both schoolwork and TV/music). To reduce the amount of noise within each activity category, responses were coded into mutually exclusive categories that reflected the participant's primary activity at the time of the interview. Coding decisions were based on an a priori conceptual hierarchy to determine which activity—if several were selected—took precedence as the primary activity. For example, if both extracurricular activity and any other activity (e.g., eating) were simultaneously endorsed, extracurricular activity was conceptualized as taking precedence and hence coded as the "primary" activity, because another activity, such as eating, would have occurred as a function of the school-based activity. Activities that were frequently coendorsed (hanging out, TV/music, and computer/game) were collapsed into one primary activity category called hanging out/media use. We omitted several activities from the analyses due to low event frequencies (shopping, job, and drug/alcohol use) or lesser theoretical importance (transit, 6% of all signals). Additionally, "nothing" was omitted because it was neither a discrete nor meaningful category; 86% of all "nothing" reports included the simultaneous endorsement of at least one primary activity (e.g., TV). Thus, this study examined the following nine mutually exclusive activities: extracurricular activity, party, physical exercise, schoolwork, phone, reading, hanging out/media use, resting, and eating meal.

Social context—Companionship at the time of each signal was evaluated using a series of items on the EMA interview that addressed the presence of others and their relationship with the participant. For this study, responses were collapsed into two categories. "Alone" included times when participants indicated that they were alone (24% of all random signals) as well as times when participants endorsed "alone, others nearby" (23% of all signals); this grouping is consistent with past time-use research with adolescents (e.g., Larson et al., 1990). Second, "with others" included times with friends (34% of all signals), family (19% of all signals), and others (12% of all signals). Of note, percentages exceeded 100% because participants may have simultaneously endorsed being with friends, family, or others.

Perceived choice and importance of activities—The perception of choice over activity engagement was assessed via a single item on each EMA interview, "About your activity: How much choice did you have in this activity?" Participants rated the extent of perceived choice on a 10-point Likert-type scale. Based on the negatively skewed frequencies of these values, choice responses were grouped into three levels to normalize the distribution: low choice (ratings of 1–6, collectively constituting 30% of all signals), medium choice (ratings of 7–9; 31% of all signals), and high choice (ratings of 10; 40% of all signals). The personal importance of activity engagement was also assessed via a single item on each EMA interview, "About

your activity: How important is this activity to you?" Participants responded using a 10-point Likert-type scale. Responses were collapsed into four levels based on frequencies of ratings: low importance (ratings of 1–5; 25% of all signals), average (ratings of 6–7; 20% of all signals); high average (ratings of 8–9; 28% of all signals), and high importance (ratings of 10; 28% of all signals). For descriptive analyses, the original continuous choice and importance variables were used; the categorical variables were used in all of the main analyses.

Demographics—Age, grade, sex, race/ethnicity, and parental education were assessed via paper-and-pencil questionnaires. As part of the larger longitudinal study, smoking history was also assessed. At baseline, 36% of the sample reported having smoked in the past 30 days.

Results

Analytic Approach

Given the hierarchically nested design of the data set, in which momentary assessments were nested within participants, the primary research questions were examined using random intercept mixed-effects regression models for continuous outcomes (MRMs; Laird & Ware, 1982). MRMs are well suited for the analysis of EMA data: these models are robust to the data dependency that occurs with the repeated assessments of individuals over time and also can handle missing data. As with linear regression models, MRMs evaluate the unique effects of each predictor variable while controlling for all other factors included in the model. Because prior research has revealed sex differences in adolescent affect (e.g., Larson et al., 2002), sex was controlled for in all analyses. Across participants, 14,592 observations were analyzed.

Participants responded to (and provided mood and activity reports for) a mean of 34.04 ($SD = 9.77$) random prompts from the EMA device across the data week. In total, participants responded to 85% of all random prompts ($SD = 13.88$).

Preliminary Analyses: Adolescent Daily Life

Table 1 displays the descriptive analyses for the mood and activity variables for the total sample and also stratified by sex. As the table reveals, the sample was not very distressed; thus, the research questions were addressed within the context of a healthy community adolescent sample. Boys reported greater PA than girls, but differences did not reach significance. In addition, average ratings of choice and importance of activities were high among all participants ($M = 7.40$, $SD = 1.41$ and $M = 7.07$, $SD = 1.60$, respectively). Perceptions of choice and importance were significantly but only moderately correlated, $r = .21$ ($p < .0001$).

Table 1 (bottom portion) displays the aggregated means and standard deviations of adolescent PA and NA within each activity; the average frequency of each activity category is also reported. Mood did not vary greatly across the activity categories when examined at the aggregate level, particularly NA. Nonetheless, adolescents reported greatest PA during party events and lowest PA when engaging in schoolwork. Similarly, NA was lowest during party times (for NA, lower scores reflect less negative mood) and highest during reading instances.

Activity–mood relations were also examined as a function of choice in activity engagement. Table 2 reports the mean PA and NA within each activity for each choice category (low, medium, and high), as well as the percentages of times adolescents reported each level of choice within an activity category. As the table illustrates, mood varied as a function of both activity type and choice level. However, within each activity, mood improved with increasing degrees of choice. Although not illustrated, similar relations were found for importance. Examination of the frequency distribution reveals considerable variability in choice within each activity,

although certain activities are predominantly higher choice (e.g., party) whereas schoolwork is loaded on the low choice end.

Emotional Experience in Social Contexts

Our first hypothesis pertained to the variations in mood across social contexts. To test this prediction, separate MRMs were evaluated for PA and NA that included social context (alone, with others), sex, and the Sex $\times$ Social Context interaction. Overall, adolescent mood was better in social situations as compared to solitary times. Adolescents reported greater PA when with friends, family, and others ($M = 6.99$, $SE = .06$) than when alone ($M = 6.55$, $SE = .06$), estimate = 0.37, $SE = .05$, $t = -2.29$, $p < .0001$. In addition, the significant Sex $\times$ Social Context interaction (estimate = 0.13, $SE = .06$, $t = 2.11$, $p = .03$) suggested that the effects of social context on PA differed for boys versus girls. Follow-up analyses revealed significant effects for both boys and girls (estimate = 0.36, $SE = .04$ and estimate = 0.50, $SE = .04$, respectively; $ps < .0001$). However, changes in PA across social contexts were slightly more pronounced for girls (estimated mean PA increased from 6.44 to 6.92 when with others, compared to times alone) than for boys (PA increased from 6.70 when alone to 7.08 when with others).

Similarly, adolescents reported significantly lower NA when with others ($M = 2.28$, $SE = .04$) as compared to times alone ($M = 2.58$, $SE = .04$), estimate = -0.26 , $SE = .03$, $t = -8.12$, $p < .0001$. Again, a significant interaction of sex and social context was found, estimate = -0.09 , $SE = .04$, $t = -2.17$, $p = .03$. Follow-up analyses revealed that social context effects were significant for both boys and girls (estimate = -0.26 , $SE = .03$ and estimate = -0.35 , $SE = .03$, respectively; $ps < .0001$), but these effects were stronger for girls than for boys. Girls' NA decreased from 2.64 to 2.30 in the presence of others, whereas boys' NA decreased from 2.51 to 2.25.

Emotional Experience in Daily Activities

To evaluate the influences of activity engagement and perceptions of autonomy in engagement on daily moods (Hypotheses 2 and 3), a "step-up approach" was used that consisted of two separate steps. First, a set of models examined whether positive and negative mood varied as a function of engagement in specific activities while allowing for between-subject variation in mood. In the second step, a series of analyses modeled the influences of choice and importance on specific activity–mood relations. This approach provided an opportunity to investigate the effects of various activities before and after accounting for the degree of autonomy (i.e., choice, importance) in activity engagement.

Given the large number of activity categories under investigation (nine categories), eight a priori activity contrasts were estimated in separate models: each activity (schoolwork, extracurricular, physical exercise, hanging out/media use, eating meal, party, phone, and reading) versus resting. Resting was selected as the referent category because it reflects engagement in a neutral or "default" activity. Thus, each model compared adolescent mood during a specific activity as compared to resting. An alpha of .01 was used due to the numerous models evaluated.

In each model, activity engagement (resting, contrast activity) was entered as two separate, uncorrelated variables reflecting the within-person and between-person effects. To partition these two sources of variance, we calculated a person-centered score for each participant as well as the aggregated person-level means. The within-person effect addresses whether an individual reports better mood during specific activity engagement, relative to their own baseline; the between-person effect estimates, at the aggregate level, which activities are associated with better mood overall. Inclusion of the between-person variable ensures that the estimated within-person effect of activity engagement on mood is not biased by differences

between participants (e.g., the proportion of times an adolescent reports partying versus resting; Schwartz & Stone, 1998). Participants must have provided at least one EMA report of each activity being evaluated to be included in the analyses; thus, sample sizes varied across models.

Results of the first step of activity comparisons are summarized in Table 3; for brevity, results for the control variable, sex, were excluded. For ease of presentation, the findings described refer to the within-person effects unless otherwise specified. PA significantly increased during party, phone, hanging out/media use, and meal events, as compared to mood when resting. PA worsened when engaging in schoolwork as compared to resting, although this effect was significant at $p < .05$ and did not meet the more stringent $p < .01$ criteria. In addition, a between-person effect was found for party (estimate = 1.95, $SE = .65$, $t = 3.01$, $p = .003$), indicating that adolescents with a greater frequency of party events overall had higher PA. For NA, mood significantly improved during party and hanging out/media use events. For all other activities, engagement did not lead to improvements or worsening of NA as compared to resting.

The Role of Autonomy in Activity Engagement

The third hypothesis maintained that the activity–mood relations are influenced by the choice and importance of activity engagement. Descriptive analyses (Table 2) revealed a pronounced linear effect of choice on the activity–mood associations, such that mood within each activity improved with increasing levels of choice; a similar pattern was found for importance. Thus, in the second step of the MRMs, perceptions of choice and importance of activity engagement were added to each of the eight activity contrast models specified previously as predictor variables. This allowed us to examine the specific activity–mood relations while controlling for differences in the degree of choice and importance of activity engagement. Results are summarized in Table 4; only within-person effects are listed in the table and described here unless otherwise specified. For these analyses, an alpha of .01 was used for significance testing.

Consistent with the hypotheses, the activity–mood relations identified in the first set of models generally became stronger and/or significant after adjusting for choice and importance. Model fit statistics also decreased with the inclusion of choice and importance (see Tables 3 and 4), indicating an improvement in model fit (Schwartz & Stone, 1998). Specifically, significant effects were found for extracurricular activities and physical exercise on PA in Step 2, indicating that PA improved when engaging in these activities as compared to resting. Phone, hanging out/media use, and eating meal also became stronger predictors of positive change in PA with the inclusion of choice and importance. A between-person effect was found for hanging out/media use (estimate = 0.93, $SE = .36$, $t = 2.60$, $p < .01$), indicating that those who more frequently engage in these activities have greater PA. However, PA did not change when engaging in reading versus resting. For NA, effects were found for hanging out/media media use.

For party, the within- and between-person effects on PA and NA did not change in magnitude after the inclusion of choice and importance; moreover, choice was not a significant factor in Step 2. Party activities thus enhanced mood, regardless of the role of choice in party engagement. Of note, the range of choice among party instances may be more restricted than among other activities. Last, after controlling for choice and importance, the marginal effect of schoolwork on PA in Step 1 disappeared. This finding indicates that the negative effects of schoolwork can be explained by the lesser degree of choice in activity engagement (see Table 2); that is, choice mediated the effects of schoolwork on PA.

In sum, positive mood significantly varied as a function of activity engagement: When controlling for choice and importance, PA improved when engaging in extracurricular activities, physical exercise, hanging out/media use, partying, eating a meal, and talking on the phone, as compared to mood when resting. In contrast, negative mood was fairly consistent

across activities, although improved during party and hanging out/media use activities. Moreover, results suggest that autonomy exerted a strong influence on mood, as findings revealed greater variation across activities after adjusting for choice and importance.

We also examined the overall influences of choice and importance on mood, aggregating across all activities. Separate MRMs were evaluated for PA and NA that included choice, importance, and the choice by importance interaction, controlling for sex. No significant interaction was found for PA (estimate = -0.02 , $SE = .02$, $t = -1.02$, ns) or NA (estimate = -0.001 , $SE = .01$, $t = -0.11$, ns), indicating that choice is important to mood regardless of the importance of an activity (and vice versa). Thus, the models were refit excluding the interaction term. Consistent with the hypotheses, results indicated that higher levels of choice and importance predicted greater PA (for choice, estimate = $.40$, $SE = .02$, $t = 21.07$, $p < .0001$; for importance, estimate = 0.12 , $SE = .02$, $t = 7.70$, $p < .0001$). Examination of the estimated means for PA revealed a linear effect: for low choice, $M = 6.26$, $SE = .06$; medium choice, $M = 6.84$; $SE = .06$; high choice, $M = 7.17$, $SE = .06$; similar patterns were found for importance. Additionally, NA improved with higher levels of choice, estimate = -0.13 , $SE = .01$, $t = -9.98$, $p < .0001$, and greater importance, estimate = -0.09 , $SE = .01$, $t = -8.89$, $p < .0001$.

Emotional Variability

Additional analyses examined whether overall levels of choice and importance in daily activities predicted another aspect of adolescent mood: emotional variability. Mood variability was assessed by computing mean standard deviation scores for PA and NA for each participant across the measurement week. Because the person was the unit of analysis, hierarchical linear regressions were conducted to explore within-person variability in mood. In each analysis, mean choice and importance were simultaneously regressed on the standard deviations of PA and NA, after controlling for sex.

Results of the regression analysis for positive mood revealed that sex ($\beta = .15$) significantly predicted emotional variability, $R = .15$, $F(1, 515) = 12.23$, $p = .001$; girls thus reported greater fluctuations in PA than boys. When choice and importance were entered into the model, only choice made a significant contribution ($\beta = -.14$, $p = .004$), suggesting that adolescent mood became more stable (i.e., less variable) with increasing levels of choice, $R = .20$, $F(3, 513) = 4.27$, $p = .015$. An identical pattern of effects was found for NA: a significant sex effect ($\beta = .14$) indicated that girls' NA was more variable than boys, $R = .14$, $F(1, 515) = 10.18$, $p = .002$. Again, choice was a significant predictor ($\beta = -.13$, $p = .006$), suggesting greater stability in NA with increased choice in activity engagement, $R = .19$, $F(3, 513) = 6.56$, $p < .001$. However, variability in mood was not influenced by the importance of activities.

Discussion

To enhance understanding of the factors underlying daily change in adolescent affect, this study utilized real time data capture methods to investigate adolescents' positive and negative moods while they went about their daily activities. Overall, results suggested that activity engagement is important for understanding daily well-being among adolescents. Consistent with predictions, daily activities were a significant source of variation in adolescents' daily moods. These findings extend previous daily events research with adults (e.g., Clark & Watson, 1988; David et al., 1997) by documenting activities as situational determinants of mood among adolescents. Yet what overwhelmed the specific event-mood relations were the adolescents' perceptions of autonomy in activity engagement. As predicted, results revealed greater associations between activities and mood after adjusting for the adolescents' perceptions of autonomy, measured as the choice and importance of activity engagement. Whereas only modest differences in average moods were found across activity categories, more striking variation was found when considering the level of autonomy in activity engagement (e.g., see

Tables 1 and 2). Hence, findings suggest that the degree of autonomy in activities may be more critical for daily affect than are the specific categories of activity. It is also important to note that *autonomy* was not synonymous with *activity*; there was variation in the reports of choice and importance within each activity category, although certain activities were predominantly lower or higher choice.

These results thus highlight the importance of incorporating relevant person-level influences to identify mood-related activities among youth. Failure to account for differences in the degree of autonomy in activity engagement may explain the weak and inconsistent positive event–mood relations found in past research with children and adolescents (Carey et al., 1986; Swearingen & Cohen, 1985; Wierzbecki & Sayler, 1991). In our study, the affective influences of daily activities were clarified when considering the degree of personal choice and value in activity engagement. As such, past examinations of main effect event–mood relations provide a limited view of the daily experiences related to adolescent affect.

Moreover, findings provide support for the relevance of autonomy-enhancing factors to adolescent well-being. Autonomy may be particularly valuable during this period as adolescents strive to establish their independence and individuate from parents (Cicchetti & Rogosch, 2002). Additionally, self-determination theory (Deci & Ryan, 1985) asserts that situational factors that satisfy the basic psychological need of autonomy, namely the perception of one's activities as self-chosen and important, enhance emotional well-being. Consistent with past research with adults (e.g., Reis et al., 2000; Sheldon et al., 1996) and youth (Veronneau et al., 2005), findings indicated that higher levels of choice and importance in individual and overall activity engagement predicted greater PA and lower NA.

Choice in activity engagement was also associated with the variability of adolescents' moods. Specifically, the perception of activities as self-chosen was associated with greater stability of emotions, whereas lower degrees of choice in activity engagement corresponded with emotional lability. Emotional volatility is a well-documented feature of adolescence (Arnett, 1999) and may confer risk for the development of more severe psychopathology during this period. For example, adolescent emotional lability is associated with increased depressive symptomatology and behavior problems (Larson et al., 1990; Silk et al., 2003). As such, factors that contribute to emotional stability may enhance adolescent adjustment.

This study also revealed that several different kinds of events were associated with increases in PA, after adjusting for the degree of autonomy in activity engagement; similar, albeit fewer, relations were found between daily activities and NA. Differential patterns for PA and NA have repeatedly been found in the daily events literature (Clark & Watson, 1988; David et al., 1997; Watson, 1988), and our results suggest that although both PA and NA improved during activity engagement, a greater range of events may influence PA than NA. Additionally, the direction of findings is congruent with theories of PA and NA as functionally distinct systems of emotion (e.g., Cacioppo & Gardner, 1999). Whereas NA is most influenced by stressful or undesirable events (David et al., 1997; Watson, 1988), PA appears to be broadly related to biological and environmental influences. These results also suggest that past examinations of activity–mood relations among youth that assessed only NA or depressed mood (e.g., Swearingen & Cohen, 1985; Wierzbecki & Sayler, 1991) may have underestimated the positive influences of activity engagement during this period. Findings thus add to the growing body of evidence on the importance of positive mood for understanding daily well-being (Clark & Watson, 1988; Weinstein, Mermelstein, Hankin, Hedeker, & Flay, in press). Of note, some similarities of findings for PA and NA may reflect their modest correlations. Moreover, similarities among PA and NA may reflect replication of findings of variation in mood across specific activities as well as the role of autonomy in daily emotional experience.

In line with past research (Clark & Watson, 1988; Watson, 1988), a robust link was found between partying and positive mood, and this link was largely independent of the autonomy–mood relation. Attending a party may increase feelings of affiliation and relatedness (Reis et al., 2000) that, in turn, enhance mood. In addition, party events involving peers may be a critical context for exploring one’s identity, building friendships, and establishing romantic relationships, factors that relate to adolescent well-being (Masten & Coatsworth, 1998). Adolescents also reported an increase in PA when hanging out (including watching television, listening to music, and playing games) as compared to their resting mood. It is unlikely that these associations were driven by social influences on mood; adolescents reported being alone during 49% of all hanging out/media media use events. Interestingly, both hanging out/media use and party events were also associated with improvements in negative mood. Adolescents reported smaller, significant improvements in positive mood when engaging in physical exercise, extracurricular activity, eating, and talking on the phone. Taken together, findings largely parallel past events–mood research with college-age students (e.g., Clark & Watson, 1988) and youth (e.g., Hansen et al., 2003) and also highlight relatively understudied mood-related activities among adolescents, such as phone use and hanging out, for future examination.

Findings also reaffirmed the importance of social interactions for emotional well-being. Consistent with adult research (e.g., Clark & Watson, 1988; Watson, 1988; Watson et al., 1992), adolescent positive and negative moods were better in social situations as compared to solitary times. Moreover, although these patterns held for boys and girls, the social activity–mood relations were especially pronounced for girls. Such findings are consistent with previous literature demonstrating similar sex differences in emotional influences of social support in adolescence (e.g., Slavin & Rainer, 1990). Several explanations have been proposed to account for the apparently robust social activity–affect relation. Social activity may foster a sense of belongingness that bolsters one’s mood (Reis et al., 2000), whereas solitude produces feelings of loneliness and alienation (Larson, 1990) that adversely influence mood. In particular, research indicates that adolescent girls perceive their social interactions to be more supportive and intimate than do boys (Furman & Buhrmester, 1992), which may heighten the emotional influences of social engagement for girls. In addition, adolescents report greater psychological activation when with others as compared to times alone (Larson, 1990), which may engender positive moods. However, these overall relations may mask more diverse findings. Adolescent mood, especially girls’ mood, has been shown to worsen in social contexts if conflict is involved (Larson & Ham, 1993), which was not examined in this study. Moreover, solitude may not be universally harmful; indeed, a moderate amount of time spent alone can be beneficial during this period (Larson, 1990).

These findings raise several implications for behavioral interventions focused on preventing and treating adolescent mood disorders. In light of the rapid and substantial intra- and interpersonal changes occurring during this developmental transition (Arnett, 1999), adolescents are at risk for developing depressive mood and disorders. Yet findings suggest that an optimal balance of required activities and the provision of choice in daily behavior may foster emotional well-being and affective stability. In addition, behavioral theories of depression assert that a low rate of positive reinforcement, via a decrease in pleasant activities, is both a causal and maintenance factor of depression (Lewinsohn, Weinstein, & Shaw, 1969). As such, explicit scheduling of pleasurable, mastery, and social activities is an integral component of empirically supported treatment for youth depression (Lewinsohn, Clarke, Rohde, Hops, & Seeley, 1996), and our findings are congruent with this behavioral approach. Moreover, results suggest that the participation in “pleasant” activities will be more effective if such events are also personally meaningful and enhance the youth’s sense of autonomy; this is consistent with cognitive–behavioral approaches (e.g., use of the Pleasant Activities

Schedule; Lewinsohn et al., 1996) in which adolescents are encouraged to independently identify pleasurable activities.

Limitations of this study should also be noted. First, the method used did not elucidate the direction of relations between activity engagement and mood. Future research should continue to explore the directionality of effects, as well as causal mechanisms underlying specific activity–mood relations. Second, the electronic diary format prevented the exhaustive examination of adolescent time use. Thus, conclusions are limited to the domain of the activities sampled in the study. Future research may consider activities that are lower in frequency but may have a high impact on mood, due to the low degree of autonomy in activity engagement (e.g., disciplinary action events). An additional limitation regarding the activity–mood relations concerns the conceptual hierarchy used to code the daily activities. The validity of the coding scheme was not examined, and results thus may be specific to the categorization method employed in this study.

Third, activity–mood relations were examined among a community sample, and thus findings may not generalize to more clinical populations. Yet despite the healthy sample, findings revealed substantial daily variation in mood. Additionally, the sample was selected based on smoking intentions and limited smoking experience. This sampling strategy may have reduced the generalizability of the findings because individuals at either end of the adjustment continuum may have been underrepresented. However, levels of depressive mood within the sample as assessed via the Children’s Depression Inventory (Kovacs, 1985) are comparable to those found in other nonclinical adolescent samples (for details, see Weinstein et al., in press), suggesting that findings do generalize to community samples. Last, given the small percentages of non-White participants, findings may not generalize to other populations.

Despite these limitations, this investigation revealed valuable information about the external and internal factors influencing change and stability in adolescents’ moods. Findings point to the importance of the adolescents’ perceptions of autonomy in activity engagement, specifically the choice in and importance of activities, for understanding daily affective patterns during this period. Moreover, these results further support the role of positive affect in day-to-day well-being among youth, and determining specific causal influences on positive mood remains a key topic for future investigation.

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Table 1
Means and Standard Deviations of Mood Variables, Overall and By Sex and Activity Category

	Positive Affect		Negative Affect		Activity Frequency		N
	M	SD	M	SD	% of Signals		
Total sample	6.73	1.23	2.44	0.97			
Boys ^a	6.83	1.25	2.42	1.02			574
Girls ^b	6.65	1.21	2.47	0.93			215
Activity							439
Extracurricular activity	7.02	2.15	2.36	1.43	3.93		574
Party	7.80	1.86	2.18	1.41	1.47		215
Physical exercise	6.88	2.15	2.42	1.48	3.01		439
Phone	6.84	2.29	2.60	1.64	4.16		607
Reading	6.80	1.98	2.49	1.54	2.27		331
Hang out/media use	7.11	2.01	2.32	1.45	34.78		5,075
Meal	6.92	2.07	2.36	1.54	3.87		565
Schoolwork	6.49	2.08	2.44	1.46	36.31		5,298
Resting	6.60	2.13	2.45	1.55	10.20		1,488

^a n = 230.

^b n = 287.

Table 2

Daily Positive and Negative Moods as a Function of Activity and Choice in Activity

Activity	Positive Affect						Negative Affect					
	Low Choice			Medium Choice			Low Choice			Medium Choice		
	M	SD	% of Signals	M	SD	% of Signals	M	SD	% of Signals	M	SD	% of signals
Extracurricular	6.35	2.13	28.60	6.89	1.79	31.70	2.71	1.57	28.60	2.52	1.39	31.70
Party	7.19	2.00	10.70	7.67	1.63	36.30	2.30	1.16	10.70	2.48	1.56	36.30
Physical exercise	6.00	2.33	24.80	6.87	1.63	30.10	3.15	1.92	24.80	2.60	1.35	30.10
Phone	5.59	2.53	11.70	6.56	2.03	37.20	3.16	1.92	11.70	2.94	1.72	37.20
Reading	5.80	2.12	20.00	6.65	1.69	27.60	3.22	1.86	20.00	2.53	1.42	27.60
Hanging out/ media use	6.27	2.13	11.10	6.97	1.81	34.00	2.72	1.72	11.10	2.52	1.46	34.00
Meal	6.27	2.32	14.50	6.88	1.86	38.90	2.51	1.59	14.50	2.50	1.40	38.90
Schoolwork	6.21	2.08	56.70	6.69	1.87	24.30	2.50	1.47	56.70	2.54	1.42	24.30
Resting	5.83	2.17	12.80	6.44	1.95	31.60	2.78	1.78	12.80	2.72	1.52	31.60

Table 3
Step 1 Mixed Effects Regression Models for PA and NA: Within-Person Activity Contrast Effects

Activity Contrast	<i>n</i>	Estimated M	SE	Parameter Estimate	SE	<i>t</i>	Model Fit ^a
PA							
Resting	404	6.57	.08	0.23	.12	1.92	4028.30
Extracurricular	164	6.93	.14	1.42	.16	8.62***	2191.50
Party	107	7.67	.16	0.31	.12	2.53	4434.50
Physical exercise	189	6.84	.13	0.37	.11	3.41**	5523.70
Phone	222	6.88	.12	0.15	.14	1.08	3306.80
Reading	142	6.66	.14	0.48	.05	8.74***	21523.30
Hang out/media use	399	7.11	.07	0.40	.11	3.66**	5669.70
Meal	238	6.88	.12	-0.12	.06	-2.09	23105.10
Schoolwork	401	6.48	.07				
NA							
Resting	404	2.43	.06	-0.06	.36	-0.72	3381.50
Extracurricular	164	2.34	.10	-0.57	.12	-4.78***	1855.60
Party	107	2.14	.12	-0.05	.09	-0.50	3766.50
Physical exercise	189	2.46	.09	0.01	.08	0.13	4631.30
Phone	222	2.56	.09	0.01	.11	0.09	2864.10
Reading	142	2.47	.11	-0.12	.04	-3.25*	17507.20
Hang out/media use	399	2.31	.05	-0.11	.08	-1.39	4843.00
Meal	238	2.40	.09	-0.01	.04	-0.34	18471.80
Schoolwork	401	2.43	.05				

Note: Sex and the between-person effects of the activity contrasts were included in each activity model; thus, the tabled effects control for these variables. Because of space limitations, the parameter values are omitted; significant between-person effects are described in the text. PA = Positive affect; NA = Negative affect.

^a -2 Log Likelihood

* $p < .01$.

** $p < .001$.

*** $p < .0001$.

Step 2 Mixed Effects Regression Models for PA and NA: Within-Person Activity Contrast Effects Controlling for Choice and Importance

Table 4

Activity Contrast	<i>n</i>	Parameter Estimate	<i>SE</i>	<i>t</i>	Model Fit ^a
PA					
Extracurricular	164	0.36	.12	2.88 [*]	4006.40
Party	107	1.37	.17	8.13 ^{***}	2178.50
Physical exercise	189	0.35	.13	2.80 [*]	4418.40
Phone	222	0.39	.11	3.65 ^{***}	5491.40
Reading	142	0.18	.14	1.32	3288.00
Hang out/media use	399	0.49	.05	9.11 ^{***}	21400.50
Meal	238	0.37	.11	3.37 ^{**}	5655.60
Schoolwork	401	0.09	.06	1.50	23012.40
NA					
Extracurricular	164	-0.09	.09	-1.05	3365.70
Party	107	-0.46	.12	-3.81 ^{***}	1839.20
Physical exercise	189	-0.08	.09	-0.92	3709.50
Phone	222	0.004	.07	0.05	4600.40
Reading	142	-0.01	.11	-0.13	2853.50
Hang out/media use	399	-0.13	.04	-3.59 ^{**}	17397.40
Meal	238	-0.05	.08	-0.62	4809.70
Schoolwork	401	-0.07	.04	-4.14	18417.20

Note: In Step 2, sex, choice, importance and the between-person activity effects were included in each activity model; thus, the listed effects control for these variables. Because of space limitations, the parameter values are omitted. Significant between-person activity effects are described in the text. For estimated means of PA and NA, see Table 3. PA = positive affect; NA = negative affect.

^a-2 Log Likelihood.

* $p < .01$.

** $p < .001$.

*** $p < .0001$.