

What Makes Lessons Interesting? The Role of Situational and Individual Factors in Three School Subjects

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The present study investigated intraindividual variation in students' interest experience in 3 school subjects and the predictive power of perceived autonomy support and control. Participants were 261 students in 7th grade. After a survey of students' individual interests and other individual characteristics, repeated lesson-specific measures of students' interest experience and perceived autonomy support and control during instruction were obtained over a 3-week period. Hierarchical linear modeling showed 36%–45% of the variance to be located at the within-student level. Moreover, perceived autonomy support and control during lessons, as well as individual interest, predicted students' interest experience in the classroom.

Keywords: interest experience, individual interest, autonomy support, self-determination theory, repeated measurement design

Five minutes before the end of a lesson, students may be waiting impatiently for the bell to ring or be so engaged in the lesson that they are quite unaware of the time. Most students are probably familiar with both experiences. Whether or not a lesson was interesting is one of the key dimensions on which students judge their experience in the classroom. Indeed, the psychological state of being interested plays a major role in students' motivation and learning (Pintrich, 2003a; Urdan & Turner, 2005). Interest has been found to be associated with focused attention, higher cognitive functioning, and learning (Ainley, Hidi, & Berndorff, 2002; Köller, Baumert, & Schnabel, 2003; Krapp, Hidi, & Renninger, 1992). However, a precise understanding of how students' interest experiences emerge in classroom settings is lacking (Pintrich, 2003b). Moreover, although interest experience is influenced by a combination of stable individual characteristics and aspects of the current situation, most research to date has investigated these two sources of influence separately. The purpose of the present study is to investigate both sources of influence directly by assessing students' interest experience in different classroom learning situations. In particular, we examine how individual students' interest experience varies from lesson to lesson within a subject domain. Furthermore, we investigate whether interest experience can be

predicted by stable individual characteristics and by situational aspects that are specific to each lesson.

In the following sections, we first introduce the construct of *interest experience* as a temporary psychological state. We then discuss stable individual characteristics that are assumed to influence interest experience. Turning to situational factors, we next draw on the framework of self-determination theory to outline features of the instructional process that are theorized to enhance interest, focusing on various forms of autonomy support.

Interest Experience

Interest experience is a psychological state that is characterized by an affective component of positive emotion and a cognitive component of concentration (Hidi & Renninger, 2006). When persons experience interest, their actions acquire an intrinsic quality; they are driven by enjoyment rather than external reasons (Krapp, 2002b). Interest is central to both intrinsic motivation and autonomous forms of extrinsic motivation (Deci, 1992; Ryan & Connell, 1989), and extreme forms of interest experience may be regarded as "flow" (Csikszentmihalyi, 1975).

States of interest arise through an interaction between the person and the surrounding context (Bergin, 1999; Sansone & Thoman, 2005). Consequently, several researchers have proposed that both situational and individual factors should be taken into account when trying to explain different levels of interest (Ainley, Hillman, & Hidi, 2002; Bergin, 1999; Hidi & Renninger, 2006; Sansone & Thoman, 2005). In the framework proposed by Krapp (2002b), the state of interest is assumed to be a function of two classes of distinct influences. The first influence comes from characteristics of the person him- or herself: stable features such as gender, prior knowledge, and experience and relatively stable preferences for certain content areas ("individual interest"). The second influence comes from characteristics of the situation. Certain features of the learning situation are assumed to be capable of arousing the individual's curiosity or interest, regardless of personal prefer-

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ences (the “interestingness” of a situation). Examples of situational features assumed to trigger interest in the classroom include games and humor (Bergin, 1999).

Several interest researchers have used the term *situational interest* to refer to the psychological state of interest (e.g., Hidi & Anderson, 1992; Schraw & Lehman, 2001). The psychological state described—that is, a state of positive emotion and heightened concentration—is congruent with our description of interest experience. However, research on situational interest has tended to emphasize that the state is provoked by external and situational stimuli, rather than by individual variables (Hidi & Renninger, 2006). The term situational interest has sometimes even been used interchangeably with *interestingness of the situation* to describe the characteristics of tasks and texts that cause the state of interest (e.g., Schraw & Lehman, 2001). Moreover, it has been argued that situational interest occurs primarily in the early phases of interest development, when individual interest is absent or very low (Hidi & Renninger, 2006). Recently, Sansone and Thoman (2005) have therefore suggested that the term interest experience be adopted as a neutral description that does not refer to the genesis of the phenomenon. This term indeed seems better suited to describe the state of interest that occurs while individuals are engaged in learning activities and to convey the idea that the phenomenological state of interest observed may be an outcome of internal and/or external influences.

There is also conceptual overlap between interest experience and the task value component of expectancy-value theory (see Wigfield & Eccles, 2002) in terms of the intrinsic qualities shared by both concepts. Four components of task value can be identified: attainment value, intrinsic value, utility value, and cost. The largest overlaps are with attainment value and intrinsic value (see Eccles, 2005). Our conceptualization thus has much in common with task value as defined in expectancy-value theory, but it is not identical. First, the task value conceptualization is broader than our construct. Second, task values are typically investigated as rather stable beliefs, whereas interest experience is assumed to be a momentary state that may or may not last after an activity has been completed.

Individual Characteristics That Influence Interest Experience

Interest experience is partly determined by individual characteristics such as gender and prior knowledge that the student brings to the instructional situation. For instance, girls are known to be more interested in certain topics (e.g., living things vs. inanimate objects) than boys (Hidi, 2006). Furthermore, students who lack necessary background knowledge and skills are less likely to experience interest in the classroom. In fact, prior knowledge has been shown to be associated with more interest experience (Alexander, Jetton, & Kulikowich, 1995). Such individual characteristics are fairly stable and unlikely to be altered by situational conditions.

The most discussed of these individual characteristics is the stable personal preference of individual interest (Krapp et al., 1992; Renninger, 2000). *Individual interest* (also referred to as *personal interest*) is defined as a relatively enduring disposition to attend to certain objects, stimuli, or events over time. It relates to specific content and is characterized by positive feelings and

values and accompanied by structured knowledge (Krapp, 2000, 2002b; Krapp et al., 1992; Renninger, 2000; Schiefele, 1991). Content-specific relationships evolve gradually from experience and biological predispositions; accordingly, the configuration of individual interest in different content areas differs across persons (Renninger, 2000). Some researchers regard individual interest as a motivational resource that helps people to cope with unfavorable learning conditions (Katz, Assor, Kanat-Maymon, & Bereby-Meyer, 2006; Silvia, 2006). When working on boring tasks, people with higher individual interest are more likely to engage in interest-enhancing strategies and to transform the activity into something more enjoyable (Sansone, Weir, Harpster, & Morgan, 1992).

Interest theory suggests that the psychological state of interest is automatically triggered when contents are perceived as relevant to one’s individual interest. Interest experience is a momentary manifestation of this latent disposition (Krapp, 2002b). Indeed, experimental studies have demonstrated that interest experience can be predicted by individual interest. Particularly in the area of text interest, Ainley, Hillman, and Hidi (2002) found that secondary students with higher individual interest in literature already anticipated higher interest after being presented with the text titles and a few sentences.¹ The authors then used “online recording” methods (Ainley, Hillman, & Hidi, 2002, p. 421) to track participants’ interest experiences during the reading process and found that these students continued to experience more interest, showed more persistence, and performed better in a recall test. Similarly, Hidi, Berndorff, and Ainley (2002) showed that general interest in writing is associated with enjoyment of writing activities. In a study involving logic problems, Katz et al. (2006) found that students with higher individual interest in logic questions were more willing to work on such tasks even when given no positive feedback. To date, most studies have been conducted in laboratory conditions, and little is known about the influential effects of prior individual interest in the classroom setting. It seems reasonable to predict that students’ individual interest in the academic domain in question is likely to be activated and in turn influences students’ interest experience.

At the same time, some findings indicate that individual interest alone is not sufficient to sustain interest experience throughout the learning process. Situational factors may also play a role in influencing students’ interest experience over and above individual characteristics. For example, Ainley, Hillman, and Hidi (2002) found that text titles generated different levels of interest experience, regardless of participants’ individual interest.

Situational Factors That Influence Interest Experience

The second source of influence on interest experience is often described as the interestingness of the learning situation in terms of its content, topics, activities, and so forth. These situational factors are naturally assumed to be less stable and more easily manipulated than individual factors. Laboratory research in the area of text

¹ Ainley, Hidi, and Berndorff (2002) labeled this kind of interest that is elicited by a word or paragraph *topic interest*. According to this definition, topic interest is very similar to interest experience. We regard it as an interest experience that occurs in the specific situation of being presented with text and as an outcome of both individual and situational factors.

interest has identified various features of interestingness, such as the coherence, seductiveness, and vividness of the text (Schraw & Lehman, 2001). Mitchell (1993) identified “catch” and “hold” components of instruction that serve to enhance students’ interest state in mathematics classrooms. For instance, using puzzles and computers may initially catch students’ interest, and emphasizing meanings and encouraging students’ involvement can further hold their interest. Bergin (1999) outlined several situational factors that teachers can apply to enhance students’ interest in the classroom, such as hands-on activities, food, games, and puzzles. Consequently, many reform-based programs have endeavored to elicit interest through components such as videos, computer-based lessons, and authentic materials (e.g., Cognition and Technology Group at Vanderbilt, 1991).

The situational factors addressed thus far concern the surface level of learning activities, such as settings and materials, rather than interactional aspects that occur during the process of instruction. In the broader motivation literature, it has been argued that students’ perceptions of classroom instruction, especially of what teachers do and say, are associated with their motivation and behaviors (Ames, 1992; Stefanou, Perencevich, DiCintio, & Turner, 2004; Turner et al., 1998). With its focus on intrinsically motivated and autonomously regulated activities, self-determination theory (SDT) can provide valuable insights into students’ interest experience. Furthermore, SDT provides a rationale for how social and environmental support can promote autonomous behaviors and engagement in learning (Deci, Vallerand, Pelletier, & Ryan, 1991).

According to SDT, intentional behaviors can be motivated by either autonomous or controlled forms of regulation. Autonomous forms of regulation include both intrinsic motivation, or behavior energized by its inherent satisfactions, and identified or integrated forms of extrinsic motivation. Here, the individual identifies with the personal importance of a behavior or assimilates its regulation to the self (Ryan & Deci, 2000a), meaning that regulation is autonomous, volitional, and valued by the self (Deci et al., 1991). Research in SDT has also repeatedly confirmed that autonomously regulated behaviors are characterized by the experience of interest (Deci, 1992; Grolnick & Ryan, 1987). By contrast, behaviors experienced as controlling (e.g., externally regulated or introjected regulations) are typically not associated with either interest or task enjoyment (Ryan & Connell, 1989; Ryan & Deci, 2000a). Accordingly, the level of autonomy support in the classroom is a key factor for understanding students’ interest (Reeve, 2002). Teachers can create an autonomy-supportive climate by attempting to understand students’ feelings and thoughts about learning tasks and by supporting students’ personal growth (Assor, Kaplan, & Roth, 2002). Specifically, autonomy-supportive instructional behaviors include listening, asking questions about students’ wishes, responding to students’ questions and acknowledging the students’ perspective, allowing students to work on their own, using praise as informational feedback, and offering encouragement (Reeve, Bolt, & Cai, 1999; Reeve & Jang, 2006; Williams & Deci, 1996).

Experimental, survey, and longitudinal studies have provided evidence to confirm the positive effects of this type of autonomy support on students’ interest and engagement (Deci et al., 1991; Krapp, 2002a, 2005; Reeve, 2002; Ryan & Deci, 2000b; Trouiloud, Sarrazin, Bressoux, & Bois, 2006; Urdan & Turner, 2005). Findings on the effects of autonomy-supportive instructional be-

haviors in authentic classroom settings are of particular interest for the current investigation (Reeve, 2002; Reeve & Jang, 2006). Students whose teachers are more autonomy oriented in their instructional style (Black & Deci, 2000; Deci, Schwartz, Sheinman, & Ryan, 1981; Ryan & Grolnick, 1986) or are given training in autonomy support (Reeve, Jang, Carrell, Jeon, & Barch, 2004) have been found to show higher intrinsic motivation, more positive emotion, and more active involvement.

In reality, however, the social arrangement of the classroom, with teachers as instructors and students as “receivers,” often leads teachers to neglect students’ need for autonomy and to resort to overly directive or controlling instructional behaviors (Assor, Kaplan, Kanat-Maymon, & Roth, 2005). During instruction, these behaviors include disrupting the students’ natural rhythm of learning (not letting them work at their preferred pace), using directive commands, making “should” statements, and asking controlling questions (see Assor et al., 2002; Reeve & Jang, 2006). These teaching behaviors have been shown to impair students’ sense of autonomy and to hinder intrinsic motivation, engagement, effort, and persistence (Ryan & Grolnick, 1986). From a self-determination perspective, these behaviors are autonomy suppressing in that the teachers fail to support their students’ need for autonomy. Moreover, these behaviors reflect teachers’ attempts to impose a teacher-centered agenda by having an instantaneous impact on students’ behavior and leaving students no room for self-reliant behaviors (Assor et al., 2002; Grolnick & Ryan, 1987). Assor et al. (2005) have demonstrated that controlling instructional behaviors and autonomy support are perceived as distinct aspects of teachers’ behavior. Controlling instructional behaviors, in particular, have a unique effect in inducing the negative emotions of anger and anxiety during the learning process (Assor et al., 2005).

Cognitive autonomy support has recently been proposed as another dimension of autonomy support (Stefanou et al., 2004). Whereas autonomy-supportive climate and controlling instruction focus on social interaction, cognitive autonomy support emphasizes the support provided for students’ engagement in cognitive activities. It has been proposed that students experience a sense of personal control at the cognitive level when teachers explain the purposes of the task at hand and its links to the learning concepts and scaffold students’ understanding by activating prior knowledge or increasing personal relevance (Schraw & Lehman, 2001; Stipek, 1996, 2002; Turner & Meyer, 2004). Despite the claim that cognitive autonomy support “truly leads to psychological investment in learning” (Stefanou et al., 2004, p. 101), there has as yet been little direct empirical investigation of the concept in classrooms. However, instructional research provides indirect support for this claim. For instance, enhancing students’ active cognitive participation has been shown to foster learning and to increase intrinsic interest and enjoyment (Brophy, 1999; Kunter & Baumert, 2006a; Stipek, 1996, 2002; Turner, 2001; Turner et al., 1998; Vermunt & Verloop, 1999). In mathematics classrooms, students show more involvement and positive affect when teachers scaffold learning and transfer responsibilities to students (Turner et al., 1998).

Within the framework of self-determination theory as reviewed above, we can thus identify three features of the instructional process that may affect students’ intrinsic motivation and interest experience: autonomy-supportive climate, controlling behaviors, and cognitive autonomy support. In the present investigation, we

conceptualize all three aspects as situational variables that may differ from lesson to lesson, rather than as features of a stable motivating style (Reeve, 1998). Evidence from experimental designs has repeatedly shown that slight manipulations in autonomy-supportive instruction can significantly affect participants' interest (Deci, Eghrari, Patrick, & Leone, 1994; Reeve, Jang, Hardre, & Omura, 2002; Vansteenkiste, Simons, Lens, Soenens, & Matos, 2005). In the present study, we examine all three instructional aspects simultaneously to determine their distinct influences on students' interest experience in authentic classroom settings.

The Present Study: Linking Situational and Individual Factors in an Intraindividual Approach

The present study investigates students' interest experience in the real-life classroom environment, examining both the situational and the individual factors that contribute to interest experience in a lesson. An intraindividual approach seemed appropriate to determine the relative effects of situational and individual factors simultaneously. In a repeated-measures design, we followed a group of students over a 3-week period, assessing their interest experience immediately after lessons. Situational factors assumed to vary across lessons were also assessed repeatedly. Multilevel modeling techniques were then applied to analyze intraindividual data and to estimate the effects of situational and individual factors simultaneously. Similar methods have been applied to investigate multilevel data in domains such as individuals' differentiated attachment patterns to different targets (La Guardia, Ryan, Couchman, & Deci, 2000), students' homework effort in different subjects (Trautwein & Lüdtke, 2007), and self-evaluation and mood in diary studies (e.g., Armeli, Carney, Tennen, Affleck, & O'Neil, 2000; Möller & Husemann, 2006).

Specifically, the present study has the following objectives. First, using a repeated-measurement design to assess students' interest experience in real-life classroom settings over time, the study offers unique opportunities to examine intraindividual variation in students' interest experience. Emotional experience has been shown to fluctuate naturally over time (Eid & Diener, 1999); therefore, it seems worthwhile to examine the extent of intraindividual variation in students' interest experience in a structured learning situation such as the classroom.

The second objective was to examine the effects of three aspects of autonomy support as situational factors. On the basis of SDT, we expected variation in students' interest experience across lessons to be predicted by the level of autonomy support experienced in the lesson, not only in terms of autonomy-supportive climate and controlling behaviors but also in terms of cognitive autonomy support. In addition, we explored whether these situational effects applied equally across all students.

Third, beyond situational factors, we examined the individual factors of gender, domain-specific grades, and individual interest. On the basis of interest theory, we expected individual interest as a stable personal preference to be associated with interest experience in situations whose content was perceived to be related. In other words, students' stable subject-specific individual interest was expected to impact their interest experience during lessons in that subject.

To examine the generality of the above hypotheses across different academic domains, we collected student data on three school

subjects. We purposely chose the core school subjects of mathematics, native language instruction (i.e., German), and the second foreign language. At least 4 lesson hours per week were dedicated to each of these compulsory subjects. It is therefore plausible to assume that students' experiences in these lessons are important for their general well-being in school. We chose the second foreign language (rather than English) as a new subject that had only recently been introduced to the students' timetables to contrast with the two old subjects of mathematics and German, in which students had several years' learning experience. This approach allows us to examine whether interest fluctuation is higher in subjects in which students have little prior experience.

Method

Participants

Participants were 261 (57% girls) seventh-grade students in Germany. The mean age was 12.3 years ($SD = 0.5$). The vast majority of participants were of European origin (> 95%) and reported speaking German with at least one of their parents (91.2%). Of those who did not speak German at home, 30% reported Turkish and 35% Polish as the primary home language. Students' participation was voluntary and required parental consent; 90% of target students participated. Students were recruited from nine classes in two public *gymnasium* schools in Berlin. *Gymnasium* is the highest track in the three-tier secondary school system in Germany; about one-third of students are enrolled in *gymnasium* schools based on their achievement in elementary school.

Procedure

The study consisted of a pretest to assess individual characteristics and a lesson-specific repeated measurement phase. In all cases, assessments were administered to classroom units. The pretest was administered in the 4th week of the school year. Lesson-specific repeated measurements began 1 week later and continued for 3 consecutive weeks. The timetables of the nine participating classes were obtained in advance in preparation for the lesson-specific repeated measurements. A maximum of four mathematics lessons, four German (native language instruction) lessons, and four to five second foreign language lessons were scheduled per week. All subjects were taught by different teachers. Data were obtained on all mathematics, German, and second foreign language lessons that took place during the 3-week assessment period. Only lessons that coincided with special events (e.g., class trip) or that did not involve regular instruction (e.g., whole lesson used for an exam) were not assessed.

Lesson-specific measures comprising 33 items were administered at the end of each lesson assessed. The teachers concluded the lesson 3–5 min earlier than scheduled, and research assistants then entered the classroom to administer the lesson-specific questionnaire. Students were instructed to respond on the basis of their experiences during that specific lesson. The first lesson assessed included a 10-min training unit to ensure that all participants understood the questionnaire and procedure. It took students less than 5 min to complete the questionnaires.

Measures

Lesson-specific measures (LSM). Students' interest experience and autonomy-related perceptions in particular lessons were measured using LSM. The same measures were used for mathematics, German, and second foreign language lessons. In designs such as daily diary studies, short instruments are often used to reduce the burden of repeated queries on participants. Some studies have relied on one- or two-item measures (e.g., Birnbaum, Reis, Mikulincer, Gillath, & Orpaz, 2006; Finkel, Burnette, & Scissors, 2007). With a view to the reliability of the measures administered in the present study, we used four to six items to assess each construct measured in LSM (all LSM items are listed in the Appendix).

Interest experience. Based on Krapp's (2002b) conceptualization, the interest experience measure comprised an emotion component and a value component. The scale contained a total of five items assessing the emotion component ("The topic was interesting to me," "I liked the topic") and the value component ("The topic was meaningful to me," "I saw what the teacher taught us can be useful in real life," and "It was important to me that I thoroughly understand my class work"). Responses were given on a 6-point scale that ranged from 1 (*disagree strongly*) to 6 (*agree strongly*). We conducted exploratory factor analyses to examine whether the items formed a unidimensional scale for interest experience. The factor analyses² showed strong support for a unidimensional factor structure, indicating that different aspects of interest experience form one construct in the LSM. The mean of all five items was therefore calculated separately for each lesson-specific measurement to form the interest experience variable. Cronbach's alpha as an index for internal consistency was calculated separately for each lesson-specific measurement; the mean Cronbach's alpha was .90 (range = .87–.93) for mathematics, .90 (range = .86–.92) for German, and .91 (range = .87–.93) for the second foreign language.³

The LSM also assessed the three aspects of autonomy support. We measured these variables from the students' perspective because individual students may experience different amounts of support or perceive the climate and instruction differently, even in the same classroom.

Perceived autonomy-supportive climate was measured by a short, six-item version of the Learning Climate Questionnaire (Williams & Deci, 1996). Items were adapted to the lesson situation (e.g., "I felt that my teacher provided me choice and options" and "I felt understood by my teacher"). Responses were given on a 6-point scale that ranged from 1 (*disagree strongly*) to 6 (*agree strongly*).

Perceived controlling behaviors were operationalized as overt and inappropriate teaching behaviors that disrupted students' natural rhythm in terms of workload or pacing and that left students little room for self-reliant behaviors. As well as behaviors that have previously been investigated as subscales of autonomy-suppressing behaviors, such as intrusive and overly demanding instructional behaviors, we included items tapping inappropriate instructional behaviors in broader terms (Assor et al., 2002). Four items tapped students' perceptions of these behaviors (e.g., "Our teacher expected split-second answers" and "Our teacher was mean to one of the students").

Perceived cognitive autonomy support measured instruction that involves students cognitively and scaffolds their conceptual un-

derstanding with five items (e.g., "More than one student presented their solution to a task" and "Our teacher emphasized the relations between the topics discussed"; Kunter & Baumert, 2006b).

We conducted exploratory factor analyses separately for each assessment of interest experience to examine the factor structure underlying all autonomy-related items. A total of 27 exploratory factor analyses (9 analyses for each of the three subjects) were conducted for the autonomy-related items. As expected, a three-factor solution emerged. Factor analyses with varimax rotation yielded eigenvalues between 4.06 and 7.46 for the first principal component and explained between 36% and 53% of the variance. This component included items pertaining to perceived autonomy-supportive behaviors. The eigenvalues of the second principal components were between 1.80 and 2.39 and explained between 13% and 18% of the variance. This component included items on perceived cognitive autonomy support. With one exception, the eigenvalues of the third principal component were also larger than 1 (range = 0.98–1.7) and explained between 7% and 12% of the variance. This component included items on perceived controlling behavior. The eigenvalues of subsequent principal components were substantially lower, as was the explained variance. The eigenvalues of the fourth principal component were between .82 and 1.14, and the explained variance was between 6% and 9%. This component included one or two items measuring controlling behaviors. Overall, 22 of the 27 (81%) exploratory factor analyses yielded three principal components larger than 1. The other five factor solutions yielded four principal components larger than 1. Based on the factor solutions, three variables of lesson-specific autonomy-related perceptions were thus calculated for each lesson-specific repeated measurement: perceived autonomy-supportive climate, perceived controlling behaviors, and perceived cognitive autonomy support. These three scales were moderately correlated with each other: Larger correlations were found between perceived autonomy-supportive climate and perceived cognitive autonomy support ($r \leq .35$); the correlations with perceived controlling behaviors were below .11 (see the correlations above the diagonals in Table 1). Cronbach's alpha was calculated for

² Exploratory factor analyses were conducted separately for each measurement at the lesson level. Nine exploratory factor analyses were conducted for each school subject (only measurement points containing data from at least 100 participants were analyzed). The same pattern emerged for all three subjects. In mathematics lessons, only the first principal component had eigenvalues larger than 1 (range = 3.7–4.4), with explained variance ranging between 62% and 73%. The eigenvalues (range = 0.55–0.93) and explained variance (below 15%) for the second principal component were much lower. Likewise, in German lessons, only the first principal component had eigenvalues larger than 1 (range = 3.5–4.4), with explained variance ranging between 58% and 73%. The eigenvalues (range = 0.56–0.95) and explained variance (below 16%) for the second principal component were much lower. Finally, in the second foreign language, only the first principal component had eigenvalues larger than 1 (range = 3.7–4.7), with explained variance ranging between 61% and 78%. The eigenvalues (range = 0.56–0.77) and explained variance (below 13%) for the second principal component were much lower.

³ Applying the same rule as in the exploratory factor analyses, Cronbach's alphas were calculated separately for measurement points on the lesson level containing data from at least 100 participants. In total, nine Cronbach's alphas were calculated for each school subject.

Table 1
Correlations Among Lesson-Specific Measures and Individual Characteristics

Variable	Mathematics				German				2-language			
	1	2	3	4	1	2	3	4	1	2	3	4
Lesson-specific measures												
1. Interest experience	—	.35**	-.12**	.34**	—	.36**	-.09**	.32**	—	.39**	-.19**	.33**
2. Autonomy-supportive climate	.57**	—	-.05*	.34**	.63**	—	-.04	.35**	.58**	—	-.10**	.34**
3. Controlling behaviors	-.19*	.18	—	.07**	.04	.20**	—	.11**	-.12*	.18**	—	.08**
4. Cognitive autonomy support	.66**	.68**	.01	—	.54**	.71**	.26**	—	.55**	.70**	.16**	—
Individual characteristics												
Individual interest	.51**	.26**	-.11	.26**	.42**	.27**	.01	.16**	.52**	.27**	-.10	.21**
Subject-specific school grade	.13*	.03	-.04	.07	-.02	.03	-.11	-.02	—	—	—	—

Note. For the lesson-specific measures, correlations above the diagonals represent within-person correlations and correlations below the diagonals represent between-person correlations. Dashes indicate that no data were available. 2-Language = second foreign language.

* $p < .05$. ** $p < .01$.

each measurement at the lesson level as an index of internal consistency. For mathematics, German, and the second foreign language, respectively, the mean $\alpha = .92$ (range = .86–.96), .92 (range = .86–.94), and .92 (range = .84–.94) for perceived autonomy-supportive climate; .66 (range = .59–.73), .64 (range = .59–.70), and .69 (range = .60–.75) for perceived controlling behaviors; and .76 (range = .62–.85), .76 (range = .58–.83), and .76 (range = .65–.84) for perceived cognitive autonomy support.

Measures of Individual Characteristics

Individual characteristics such as individual interest, school grades, and gender were assessed at the pretest. A 7-item scale was used to assess individual interest in mathematics, German, and the second foreign language (Ramm et al., 2006). These items (e.g., “I do [subject matter], because it is fun for me” and “For me, [subject matter] is personally important”) were based on earlier work (e.g., Marsh, Trautwein, Lüdtke, Köller, & Baumert, 2005). Students responded to each question in separate columns for mathematics, German, and the second foreign language. Responses were given on a 6-point scale anchored by the end points 1 (*disagree strongly*) and 6 (*agree strongly*). Cronbach’s alphas for mathematics, German, and the second foreign language were .92, .87, and .91, respectively. Students were also asked to report the mathematics and German grades they had been awarded on their sixth-grade report cards (i.e., at the end of elementary school). Elementary school grade for second foreign language was not available because the students had not been introduced to this subject until the seventh grade. The German grading system ranges from 1–6, with smaller numbers indicating better performance. To maintain consistency with the other scales, we reverse coded the grades such that a higher value indicates better performance. Gender was coded 0 for female and 1 for male.

Statistical Analysis

Analyzing hierarchically structured data. The repeated measures design results in a two-level hierarchical structure with LSMs nested within each individual student. At the within-student level (Level 1), we tested a number of repeated LSMs collected for each student over the 3-week period. At the between-student level

(Level 2), we assessed variations in student characteristics including gender, individual interests, and school grades.

Hierarchical linear modeling (HLM; Raudenbush & Bryk, 2002) is capable of handling hierarchically structured data that violate the assumption of independence. Furthermore, HLM identifies variance in multiple levels of the data—in our case, at the within- and between-students levels. Moreover, HLM allows simultaneous estimation of effects of predictors from different levels. Detailed descriptions of the models are provided with the results. All analyses were conducted using the program HLM (version 6; Raudenbush, Bryk, Cheong, & Congdon, 2004).

Treatment of missing values. Our data set contained three types of missing data: first, missing responses to some of the items in the LSMs; second, missing responses to measures of individual characteristics in the pretest; and third, missing data caused by students’ absence in some of the lesson-specific assessments. Because HLM allows unequal numbers of observations for each individual, missing data of the third type were not a problem. The first two types of missing data were not considered problematic because the rate for each was less than 3%. Different approaches have been shown to produce satisfactory results when the missing rate is below 5% (Graham, Cumsille, & Elek-Fisk, 2003). In the present study, a multiple imputation procedure was chosen (Peugh & Enders, 2004). All available data from the lesson-specific and pretest measures were used to estimate the missing values, including demographic and motivational variables that were not used in the present investigation. The NORM software (Version 2.03; see Schafer & Graham, 2002) was used to generate five data sets in which missing data were replaced by estimated values. All HLM analyses were conducted with the five complete data sets, and combined results are reported (Schafer & Graham, 2002). The descriptive statistics reported below are based on the raw data set.

Results

Descriptive Analyses

A total of 6,468 completed lesson-specific questionnaires were obtained; students participated in an average of 8.4 measurements

(range = 5–11) in mathematics lessons, 8.0 measurements (range = 2–10) in German lessons, and 8.4 measurements (range = 6–11) in second foreign language lessons.

For exploratory purposes, mean values of lesson-specific measurements were calculated for each individual student for mathematics, German, and the second foreign language separately. Descriptive statistics for these person-mean LSMs are presented in Table 2. In general, students' person-mean scores on interest experience tended toward the positive end of the 6-point scale. In terms of autonomy support, within-person means for autonomy-supportive climate and cognitive autonomy support were around the midpoint of the scale, whereas person-mean scores on perceived controlling behaviors were low.

Intercorrelations among LSMs and individual characteristics are presented in Table 1. Two types of correlations were computed for the LSMs: between-person correlations and within-person correlations. Between-person correlations were calculated using the mean scores for each student. As shown under the diagonals in the top panel of Table 1, person-mean interest experience was moderately associated with person-mean autonomy-supportive climate ($r \geq .57$) and person-mean cognitive autonomy support ($r \geq .54$), indicating that students who reported higher average interest experience also reported higher average autonomy-supportive climate and cognitive autonomy support. Findings on the association between person-mean interest experience and person-mean controlling behaviors were mixed across three subjects.

Regarding the relations to individual characteristics, students' person-mean interest experience correlated significantly with individual interest in the corresponding academic domain as measured in the pretest ($.42 \leq r \leq .52$). Smaller but significant correlations were found between autonomy-supportive climate and perceived cognitive autonomy support and individual interest ($.16 \leq r \leq .27$). No significant associations were found between perceived controlling behaviors and individual interest.

Second, within-person correlations were calculated using all lesson-specific data. These within-person correlations indicate the correlation structure across lessons for individual students. In order to partial out the between-person variance, each student's person-

mean value was subtracted from his/her raw scores, such that every student had the new mean value of zero. Next, all lesson-specific scores from students were used to calculate the correlations. As shown above the diagonals in the top panel of Table 1, interest experience correlated significantly with all three autonomy-related perceptions. It has been suggested that the within-person correlation structure may reveal different results from the between-person correlation structure (Michela, 1990). In our case, the within-person correlations showed that students reported less interest in lessons where they perceived more teacher control, but this association was not always significant across school subjects in the between-person correlations. In the next section, we examine the within-student and between-student variance simultaneously with HLM models.

Examining Intraindividual Variation in LSMs

We used an unconditional model to examine variance in interest experience at the within-student and between-student level. If a student tends to produce similar responses across lessons, the proportion of variance at the within-student level will be low. Separate models were calculated for mathematics, German, and the second foreign language. The results show that the proportion of variance at the within-student level was substantial: 36% in mathematics, 45% in German, and 36% in the second foreign language. Therefore, our findings supported the hypothesis of lesson-to-lesson variation in students' interest experience.

In addition, unconditional HLM models were applied to analyze the variance components of the three autonomy-related LSMs. Proportions of within-student variance were 36%–38% for perceived autonomy-supportive climate, 52%–58% for controlling behaviors, and 44%–50% for cognitive autonomy support. The sizeable variances in both interest experience and the three predictors justified our further attempts to predict interest experience by reference to three autonomy-related perceptions at the within-student level.

We begin with a detailed description of the HLM analyses incorporating predictors from both levels. The analyses served two main objectives. First, we examined whether students' interest experience during lessons could be predicted by situational factors of the lesson (i.e., within-student level predictors). Second, we investigated whether individual differences in interest experience could be predicted by student characteristics (i.e., between-student level predictors). Models were fitted using restricted maximum likelihood estimation. The results for within-student and between-student level predictors are described in the following sections.

First, at the within-student level, we investigated how interest experience is predicted by the three autonomy-related perceptions using the regression equation below.

$$\text{Interest}_{ij} = \pi_{0i} + \pi_{1i}\text{Autonomy} + \pi_{2i}\text{Control} + \pi_{3i}\text{Cognitive} + \epsilon_{ij},$$

where Interest_{ij} is the interest experience of the i th student in the j th lesson; π_{0i} represents the intercept of the i th student; π_{1i} , π_{2i} , π_{3i} represent the regression coefficients for the three autonomy-related perceptions; and ϵ_{ij} is random within-person error. All three predictors were group-mean centered (here, person centered). This procedure tests specifically whether interest experience is ex-

Table 2
Person-Mean Lesson-Specific Measures and Measures of Individual Characteristics

Variable	Mathematics		German		2-language	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Lesson-specific measures						
PM Interest experience	3.94	1.18	3.95	1.09	4.11	1.15
PM Autonomy-supportive climate	3.05	1.13	3.16	1.15	3.15	1.12
PM Controlling behavior	1.95	0.73	1.71	0.62	1.92	0.70
PM Cognitive autonomy support	3.46	1.04	3.11	1.01	3.14	1.03
Individual characteristics						
Individual interest	3.90	1.34	3.82	1.06	4.57	1.11
Subject-specific school grade	4.84	0.77	4.99	0.55	—	—

Note. All items were rated on a 6-point scale with 6 as the highest value. Dashes indicate that no data were available. PM = person-mean; 2-language = second foreign language.

plained by different autonomy-related perceptions relative to an individual student’s own baseline. Alternative procedures (e.g., no centering or grand-mean centering) are less suitable for the present investigation, because the results might be caused partly by students’ different baselines. The present approach allows effects purely at the within-student level to be disentangled.

Turning to the between-student level, the parameters are further modeled by individual characteristics as follows:

$$\pi_{0i} = \gamma_{00} + \gamma_{01}\text{Male} + \gamma_{02}\text{IndInt} + \gamma_{03}\text{Grade} + \zeta_{0i}$$

$$\pi_{1i} = \gamma_{10}$$

$$\pi_{2i} = \gamma_{20}$$

$$\pi_{3i} = \gamma_{30}$$

The first equation predicts the intercept π_{0i} —the average interest experience of the i th student—derived from a Level 1 equation. Here, it is predicted by the individual characteristics of gender, individual interest, and school grade. The γ_{00} represents the grand mean of the sample accounting for the effects of gender on the students’ mean interest experience (γ_{01}), the effects of individual interest and prior school grades (γ_{02} and γ_{03}). The ζ_{0i} reflects random error at the between-student level. The next three equations indicate that the within-student level regression parameters π_{1i} , π_{2i} , and π_{3i} are treated as fixed effects and thus only predicted by the intercepts γ_{10} , γ_{20} , and γ_{30} . All continuous variables were z -standardized prior to multilevel modeling.

Predicting Interest Experience With Situational Factors

Model 1 tested the effects of the three within-student level predictors that are presented in Table 3. The three school subjects are modeled separately. The hypothesized associations between the three autonomy-related perceptions and the change in students’

interest from lesson to lesson were all supported. As shown, students experienced more interest in lessons where they perceived (relative to their own baseline) a more autonomy-supportive climate, more cognitive autonomy support, and less controlling behavior. In mathematics lessons, for example, autonomy-supportive climate and cognitive autonomy support had moderate effects, with B values of .25 and .23, respectively. In other words, one standard deviation increase in autonomy-supportive climate and cognitive autonomy support was associated with one quarter of a standard deviation increase in interest experience. The effect of controlling behavior was statistically significant but smaller, at $B = -.10$. A consistent pattern of results was found across all three subjects. Overall, over 19% of the variance at the within-student level was explained by the three autonomy-related perceptions.

Predicting Interest Experience With Between-Student-Level Factors

Turning to the between-student level, we examined whether the differences in students’ average interest experience could be predicted by the individual characteristics of gender, individual interest, and school performance. As shown in Table 3 (Model 1), we found a unique effect of individual interest among the three individual characteristics, with coefficients between .35 and .46 across the three subjects. Interest experience was thus significantly predicted by individual interest in the subject. There were no significant effects of gender or school grades on interest in the subject. Overall, the individual predictors explained 27% of the variance at the between-student level in mathematics, 19% in German, and 27% in the second foreign language.

One open question remains regarding the effects of individual characteristics. Is it possible that some students reported higher average interest experience because lessons were constantly more

Table 3
Using Hierarchical Linear Modeling to Predict Interest Experience

Predictor	Mathematics				German				2-Language			
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
	<i>B</i>	<i>SE</i>	<i>B</i>	<i>SE</i>	<i>B</i>	<i>SE</i>	<i>B</i>	<i>SE</i>	<i>B</i>	<i>SE</i>	<i>B</i>	<i>SE</i>
Within-student level												
Autonomy-supportive climate	.25***	.03	.25***	.03	.31***	.03	.31***	.03	.28***	.03	.28***	.03
Controlling behaviors	-.10***	.02	-.10***	.02	-.10***	.02	-.10***	.02	-.14***	.02	-.14***	.02
Cognitive autonomy support	.23***	.03	.23***	.03	.23***	.03	.23***	.03	.22***	.03	.22***	.03
Between-student level												
Gender ^a	-.13	.09	.02	.07	.01	.09	.07	.07	.04	.09	.03	.07
Individual interest	.46***	.05	.28***	.04	.35***	.04	.24***	.04	.44***	.04	.29***	.04
Subject-specific school grade	-.06	.04	-.04	.03	-.08	.04	-.06	.04	—	—	—	—
PM autonomy-supportive climate			.19***	.06			.34***	.06			.26***	.05
PM controlling behaviors			-.15***	.03			-.09**	.03			-.15***	.04
PM cognitive autonomy support			.35***	.06			.16**	.06			.23***	.05
Explained variance												
Lesson level	.19		.19		.19		.17		.23		.23	
Individual level	.27		.63		.19		.52		.27		.57	

Note. Lesson-level predictors were group-mean centered. Dashes indicate that no data were available. PM = person-mean; 2-Language = second foreign language; B = unstandardized regression coefficient resulting from hierarchical linear modeling analyses; SE = standard error.

^a Gender coded: girl = 0 and boy = 1.

** $p < .01$. *** $p < .001$.

autonomy supportive for them? Group-mean centering had removed the information on students' baseline lesson perceptions. Therefore, in order to examine the effect of individual characteristics after controlling for the general level of the three autonomy-related lesson perceptions, we followed the recommendation by Kreft and de Leeuw (1998, p. 108) and added the subtracted mean structure of the three group-mean centered predictors back into the models as between-student predictors. Another set of HLM models (Model 2) was thus specified that included averaged within-student level predictors at the between-student level.

In Model 2, the significance pattern of individual characteristics effects remained the same for all school subjects. The effects of individual interest decreased but remained statistically significant; the effects of gender and school grade remained nonsignificant. The regression coefficients for individual interest ranged between .24 and .29 in three school subjects. The coefficients indicated that, even when the overall level of the three autonomy-related lesson perceptions was controlled, students' individual interest was still related to interest experience. The overall variance explained by between-student level predictors increased by at least 30% when the person means of three autonomy-related lesson perceptions were included.

Examining Variation in the Effects of Situational Factors Across Students

Thus far, the HLM models have assumed that the effects of within-student level predictors are the same for all students. To explore whether the effects of autonomy-supportive climate, controlling behavior, and cognitive autonomy support apply equally to all students, we conducted an additional set of so-called random effect models. In between-student-level HLM equations, random components were specified for π_{1i} , π_{2i} , and π_{3i} . In other words, a total of nine random components were examined for all school subjects. The results of the random effect model showed that all nine variance components for within-student-level regression coefficients were significant, indicating that the effects of autonomy-supportive climate, cognitive autonomy support, and perceived controlling behaviors on interest experience vary substantially between students. To gain insight into the magnitude of variation, we followed the recommendation of Raudenbush and Bryk (2002, p. 78), and calculated the 95% plausible value range of the slopes using information on the average slope and the slope standard deviation. The largest range of effect was found for autonomy-supportive climate in mathematics lessons: The average slope was 0.27 and the standard deviation was 0.26. It follows that the effect ranged between $0.27 - 2 \times 0.26 = -.25$ and $0.27 + 2 \times 0.26 = 0.79$ for approximately 95% of the students in the present study. The smallest range of effect was found for perceived controlling behaviors in mathematics lessons, at between -0.36 and 0.16 .

These results revealed meaningful difference across students that warrants further examination. We ran exploratory models in an attempt to explain this variation in terms of students' individual characteristics. Specifically, we examined whether these differences in the slopes across students were explained by gender, individual interest, or school grades. Two statistically significant results emerged. In mathematics lessons, the effect of perceived controlling behaviors was moderated by individual interest ($B = -.05, p = .029$), and in second foreign language lessons, the effect

of autonomy-supportive climate was moderated by individual interest ($B = -.10, p = .002$). These findings indicated that students with higher individual interest were less affected by the controlling behaviors of their mathematics teachers or by an autonomy-supportive climate in second foreign language lessons. Overall, rather little of the difference across students was explained by the three individual characteristics.

Discussion

The multilevel analyses conducted to investigate students' interest experience in authentic learning situations revealed three main findings. First, there was substantial intraindividual variation in students' interest experience in day-to-day classroom learning. Second, the pattern of variation was predicted by the situational factors of autonomy supportive climate, controlling behaviors, and cognitive autonomy support in lessons. The effects of situational factors were consistent across the three subjects investigated. Third, students who started with higher domain-specific individual interest had higher interest experience in average lessons.

Interest Experience in Lessons: Intraindividual Variability

The present study is among the first to investigate how students' interest experience emerges and endures in the classroom over a relatively short period of time. Over three weeks, in an average of eight lessons, variance in interest experience at the within-student level accounted for between 36% and 44% of the overall variance. Whereas between-student variance indicates that interest experience differs from one student to another, within-student variance indicates that interest experience also differs within students from one lesson to another. Moreover, the amount of intraindividual variation observed was very similar across the three subjects examined, although it was slightly higher in German lessons (44%). The extent of variation in the structured learning condition of the classroom thus seems to be similar across domains. To counter the possibility that such within-student variation is mainly due to measurement error, we used a 5-item scale with good internal reliability in the present study. Furthermore, the finding that intraindividual variability covaries with lesson perceptions also indicates that the pattern of results is more meaningful than random fluctuation.

The psychological state of interest is not a fixed entity. Even individuals who generally enjoy reading are more interested in some texts or topics than others (Ainley, Hidi, & Berndorff, 2002; Ainley, Hillman, & Hidi, 2002). To date, most research on interest variation has been carried out in laboratory settings and has focused on text-based processing. The present findings confirm that variation in interest state is observable not only in laboratory settings but also in authentic classrooms across a wide range of topics and activities. The students in our sample, who had six years of classroom learning experience and had already attended numerous lessons in certain subjects, nevertheless experienced some lessons as more interesting and engaging than others. These results challenge the beliefs of some teachers that many students are just not interested and cannot be motivated. The finding that students are sensitive to the learning conditions afforded by the teacher is encouraging for teachers. At the same time, the challenge remains

of how to create an interesting and motivating learning environment.

Instructional Features and Interest Experience

Which instructional features make a lesson substantively different from others? SDT proposes that individuals have a basic need to feel self-determined or autonomous, and that teachers' autonomy support during instruction can facilitate satisfaction of this psychological need (Reeve, 2002). Teachers' autonomy-supportive behaviors have previously been shown to generate more engagement and effort among students (Reeve et al., 2002, 2004). Our study extends these beneficial effects to include students' interest experience. Lessons in which students perceive the teacher taking their perspective and understanding what they want (i.e., an autonomy-supportive climate) are associated with higher interest experience; in contrast, lessons in which teachers disrupt students' natural learning rhythms and do not allow time for reflection (i.e., controlling behaviors) were associated with lower interest experience. The factor solution and small within-person correlations showed that teachers' controlling behavior is a distinct construct from autonomy-supportive teacher behaviors. Moreover, teachers' controlling instructional behaviors seem to be associated with negative student emotions, such as anxiety in the classroom (Assor et al., 2005; Tsai, Kunter, Lüdtke, & Trautwein, 2007). Following the conceptualization of Assor et al. (2002), we measured the construct of controlling behavior in broader terms than has been done in many previous studies. Our items also covered inappropriate instructional behaviors that have been proposed to undermine students' sense of autonomy. Whether the level of autonomous behavior mediates the relation between controlling behavior and interest experience will have to be investigated directly in future research.

Moreover, beyond the social interaction aspect of autonomy-supportive climate, we found a distinctive effect of *cognitive autonomy support*. Stefanou et al. (2004) hypothesized that cognitive autonomy support gives students an enhanced sense of control, particularly during engagement with cognitive activities (e.g., problem solving). Cognitive autonomy is supported when the teacher explicitly explains the aim of tasks and activates students' prior knowledge during their implementation. Within SDT, this kind of practice is discussed in terms of the rationale it provides students for grasping and assimilating the value and meaning of an activity, which has been experimentally shown to facilitate more interested engagement with a task (e.g., Deci et al., 1994). That being said, cognitive autonomy differs from a perceived expectation or standard in the classroom to perform well or to learn harder (cf. academic press for understanding, Middleton & Midgley, 2002). Our study provides empirical evidence within actual classroom settings of the engaging effect of cognitive autonomy support as proposed by Stefanou et al. (2004) by demonstrating the effects of cognitive autonomy support over and above those of autonomy-supportive climate and controlling behaviors. Our findings indicate that lessons in which students' prior knowledge and conceptual understanding are activated and the aims of tasks are transparent to students are associated with enjoyment.

Furthermore, the present findings indicate that perceived autonomy support may depend on what teachers say and do in the classroom and that it is less stable than teachers' individual char-

acteristics. Relative to each student's own baseline, some lessons were perceived as more autonomy supportive than others. Therefore, it might be possible to enhance interest in lessons by providing teachers with training in autonomy-supportive teaching (Reeve, 1998).

The consistent findings across the three subject domains indicate that the beneficial effects of autonomy support are quite general and probably apply to other subjects as well. Nevertheless, the significant variation in the effects found among students indicates that some students seem to react more to teachers' autonomy support than others. To understand how autonomy support can benefit different types of students, the underlying processes moderating these effects need to be further investigated.

Individual Interest and Interest Experience

Interest theory predicts that people who have a stable preference for a certain subject domain or content will seek out related activities and that they will enjoy and value opportunities to reengage with relevant contents. As Krapp (2002b; Krapp et al., 1992) argued, individual interest can be conceptualized as a stable person-object relation that, once developed, will influence the quality of further interactions. The present findings clearly show that students' individual interest in a school subject, measured at the beginning of secondary school, significantly predicts their interest experience in the respective lessons over a 3-week period. It is surprising that effects of a similar magnitude were also found for a newly introduced subject (i.e., second foreign language). We had not expected the person-object relation to be as well developed in this context. Whether individual interest in this subject is a function of prior experience outside school or inferred from other related domains (e.g., general interest in foreign language) remains to be investigated.

Our findings indicate that individual interest can be regarded as a motivational resource for students in everyday classroom learning situations (Katz et al., 2006; Sansone et al., 1992). Although lessons may not always coincide with their preferences, and external support may differ from one day to the next, students with higher individual interest in a subject are more likely to have positive learning experiences in the respective lessons. Elementary school grades did not prove to be associated with interest in secondary classrooms. Nevertheless, the association found between individual interest in the subject and interest experience was not perfect. An interest state is rarely triggered by individual interest alone, even when individual interest is very strong (Hidi & Renninger, 2006). A comprehensive account of interest state needs to take other motivational resources and situational factors into account.

Toward the Integration of Situational and Individual Factors in Interest Theory

The present study showed that interest experience as a momentary psychological state is influenced by both situational factors and individual characteristics. Although similar approaches have already been proposed in the interest literature (e.g., Hoffmann, Krapp, & Renninger, 1998), most researchers have investigated either the situational aspect (i.e., situational interest) or the dispositional aspect (i.e., individual interest), meaning that one source of

influence has generally been neglected. For instance, most studies on situational interest have overlooked the influence of individual characteristics (see Schraw & Lehman, 2001, for a review). Working within this framework, it would also be possible to examine the relative importance of other situational factors proposed in the literature with respect to further individual characteristics or motivational resources. Moreover, the interaction between the two sources of influence (e.g., for which persons certain situational factors are effective) could be further investigated.

Broadly speaking, the intraindividual variability observed in interest experience across situations is in line with state–trait theories from personality and social psychology (Eid & Diener, 1999; Steyer, Schmitt, & Eid, 1999), which predict emotion and behavior to have both state and trait aspects. Students' interest and other emotional experiences should be no exception. In fact, much of literature has referred implicitly to the state–trait distinction. It remains for empirical research to examine the magnitude of intraindividual variability in interest across time and situations and to determine whether this intraindividual variability differs across educational environments, phases of interest development, or different trait levels of individual interest.

Limitations and Future Research

The results of the present study are in line with hypotheses derived from SDT and interest theory, but several empirical limitations warrant discussion. First, the effects of situational factors (e.g., autonomy-supportive climate) established with multilevel analysis are correlational in nature; therefore, inferences cannot be drawn on the causal direction of the effects of the three situational factors on interest experience. For instance, it is possible that teachers pay more attention to students who show interest during the lesson and give them more positive feedback, and thus they are perceived by these students to be autonomy-supportive. Additionally, there is a possibility of third-variable explanations. For instance, external pressures (e.g., impending examinations) may prime negative mood in students (and perhaps also the teacher) and bias both interest experience and the learning situation in a negative direction. To address this limitation, future studies might investigate the effects in a sequence of experimental learning conditions that allow situational factors to be controlled or manipulated.

Second, data on both interest experience and situational factors of the lesson were obtained from students' self-reports. Some relations may therefore be overestimated due to shared method variance. Further research might address this issue by using multiple sources of information (e.g., teacher reports, third-person observations, analysis of instructional tasks) to provide more objective perceptions of instruction (Kunter & Baumert, 2006b).

A third limitation relates to the generalization of the results. Participants in the present study were sampled from the same grade and the same academic track of the three-tier German secondary educational system. To establish their generalizability, the effects observed in the present study need to be replicated in more heterogeneous samples, and at different points in student development. Replication of the present results in samples of different ages and cultural backgrounds would support the claim of self-determination theory that autonomy support is universally beneficial for all individuals.

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Appendix

Items of the Lesson-Specific Measures

Interest Experience (5 items)

- I enjoyed the topic.
- It was interesting to me.
- The topic was meaningful to me.
- It was important to me that I thoroughly understood the material covered.
- I saw that the content of the lesson can be useful in real life.

Perceived Autonomy-Supportive Climate (6 items)

- I felt that my teacher provided me choice and options.
- I felt understood by my teacher.
- My teacher conveyed confidence in my ability to do well in the course.
- My teacher encouraged me to ask questions.
- My teacher listened to how I would like to do things.
- My teacher tried to understand how I see things before suggesting a new approach.

Perceived Controlling Behaviors (4 items)

- Our teacher expected split-second answers.
- Our teacher's instructions were so vague that nobody knew what to do.
- Our teacher covered so much material that we had difficulty keeping up.
- Our teacher was mean to a student.

Perceived Cognitive Autonomy Support (4 items)

- We worked through exercises that helped us understand the topic.
- Different students presented their solutions to the same task.
- Our teacher set tasks that required time to reflect.
- Our teacher emphasized the relations between the topics discussed.

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