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Intra-Individual Dynamics of Lesson-Specific Engagement: Lagged and Cross-Lagged Effects From One Lesson to the Next

Short title: *ENGAGEMENT FROM LESSON TO LESSON*

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Abstract:**Background:**

Student engagement denotes active participation in academic work through commitment and involvement in learning tasks (Appleton et al., 2006). This study looks at questions such as whether engagement experiences in one lesson have an effect on the next lesson. In the present study, process-oriented analyses were conducted to examine lower secondary school students' engagement experiences and the stability of those experiences from one lesson to the next.

Aims:

1. To what extent are students' engagement experiences, in terms of behavioural and cognitive engagement, emotional engagement, and disaffection, stable from one lesson to the next (autoregressive cyclic effects)?
2. What are the cross-lagged relationships (dynamic effects) between engagement experiences from one lesson to the next?

Sample:

The sample consisted of 56 Finnish lower secondary school students. The students provided ratings of their engagement experiences at the end of each lesson for one week (five days, 975 ratings). Each student rated, on average, 17.4 lessons ($SD = 5.67$).

Methods:

We specified multilevel dynamic structural equation models with random slopes.

Results:

The models showed small significant sustainability in behavioural and cognitive engagement, emotional engagement, and disaffection from one lesson to the next, regardless of subject matter and teacher continuity. Higher behavioural and cognitive engagement in a lesson also had a self-diminishing effect on disaffection.

Conclusions:

The present study provides valuable information to teachers by showing that an experience in one lesson can have an effect on subsequent ones.

Keywords:

engagement, intra-individual, situation-specific engagement, lower secondary school, dynamic structural equation modeling

Data availability statement:

The data that support the findings of this study are available from the corresponding author upon reasonable request. Data: Lerkkanen, M.-K., Niemi, P., Poikkeus, A.-M., Poskiparta, E., Siekkinen, M., & Nurmi, J.-E. (2006–2016). *The First Steps study [Alkuportaati]*. Unpublished data. Jyväskylä, Finland: University of Jyväskylä.

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1. Introduction

Considerable evidence has highlighted the importance of student engagement for learning in school (Appleton, Christenson, Kim, & Reschly, 2006; Fredricks, Blumenfield, & Paris, 2004). Student engagement research, however, has at least three major limitations. Firstly, most of the previous studies have focused general engagement with school and only a small portion have empirically examined students' real-time learning experiences, such as lesson-specific engagement (Heemskerk & Malmberg, 2020; Martin et al., 2015; Pöysä et al., 2018; Salmela-Aro, Moeller, Schneider, Spicer, & Lavonen, 2016; Schneider et al., 2017; Shernoff et al., 2015). This is surprising because situation-specific behaviour and emotions are crucial for understanding processes over time (Hamaker, 2012) and such research is particularly important for a construct like engagement, which is seen as complex and malleable (Fredricks, Filsecker, & Lawson, 2016). Dynamic processes cannot be captured by a single occasion of measurement. Secondly, existing studies have typically examined inter-individual differences in terms of engagement and the factors that explain these individual differences. However, there might be individual differences in how engagement experiences fluctuate between lessons; more studies focusing on the variation between lessons within individuals (i.e., intra-individual variation) are needed to draw conclusions about learning experiences at the individual level (Heemskerk & Malmberg, 2020; Molenaar, 2004; Salmela-Aro et al., 2016; Schneider et al., 2017). Thirdly, little is known about the temporal dynamics of learning experiences, although such modeling would enable the estimation of stability of experiences and the effect of each experience on another from one lesson to the next. Only a few studies focusing on the experiences of learning have explicitly modeled associations between concurrent and lagged time points (Malmberg & Martin, 2019; Musher-Eizenman, Nesselroade, & Schmitz, 2002; Schmitz & Skinner, 1993) and none of them have focused on the stability of student engagement from one lesson to the next. Such modeling

would provide important information regarding how learning is experienced during a sequence of school lessons at the individual level. Increasing understanding of this issue may provide insight into how each lesson can play a crucial role in supporting students' general engagement in school. Engagement drops during the pre-adolescent and adolescent years (Lam et al., 2016; Wigfield, Eccles, Schiefele, Roeser, & Davis-Kean, 2006). Consequently, we focused on the lesson-specific engagement experiences of lower secondary school students. Our aim was to examine the stability of different engagement experiences from one lesson to the next.

1.1 Student Engagement

Student engagement involves active participation in academic work and includes factors such as commitment and involvement in learning tasks (Appleton et al., 2006). The specific dimensions to include in the overall concept of student engagement has recently been debated (Fredricks et al., 2016). Student engagement has typically been defined as a multidimensional construct consisting of three components: (1) *behavioural engagement*, which includes on-task behaviour, involvement, and persistence in academic activities during a lesson; (2) *emotional engagement*, which encompasses feelings toward teachers, classmates, learning, and schools and (3) *cognitive engagement*, which involves the concentration, attention, and cognitive investment used to comprehend complex ideas and master difficult skills (Fredricks et al., 2004).

Components of engagement have also been operationalised differently across studies. For example, the operationalization of behavioural engagement in some studies is similar to the operationalisation of cognitive engagement in other studies (Fredricks et al., 2016). Additionally, in some studies emotional engagement includes both positive and negative emotions (Fredricks et al., 2016) while others assess negative

emotions and maladaptive behavior as a separate construct (Jang, Kim, & Reeve, 2016; Skinner, Kindermann, & Furrer, 2009). For example, Skinner et al. (2009) proposed a disaffection component to address negative emotions and lack of attention, defined by factors such as tiredness and boredom, in contrast to emotional engagement, which was defined through energized emotional states such as pleasure and enjoyment.

In this study, we focused on components of student engagement during school lessons in lower secondary school and on the students' experienced behavioural and cognitive engagement (how prepared they were for the lesson, how much they concentrated, how persistent they were, whether they planned ahead, whether they complied with teachers' wishes or invested effort in pleasing the teacher), emotional engagement (including positive emotions, such as liking a lesson and finding it enjoyable), and disaffection (including negative emotions, such as boredom and tiredness). We were not able to statistically separate the behavioural and cognitive engagement components from each other (Vasalampi et al., 2016) and therefore combined them into one dimension that we called behavioural and cognitive engagement. These included concentration and persistence in learning tasks, invested effort in pleasing the teacher, and planning learning tasks in advance. We also conceptualised disaffection and emotional engagement as distinct constructs based on previous papers by Jang et al. (2016) and Skinner et al. (2009) and our own previous findings (Vasalampi et al., 2016). Such conceptualisation is also in line with previous results, indicating that positive emotions can exist entirely independently from negative emotions, not just in opposition to them (Diener & Emmons, 1984). It is possible, for example, for a student to like a lesson, but also feel tired.

Developmental studies of engagement have shown an overall decline in students' behavioural, emotional, and cognitive engagement from year to year (Lam et

al., 2016; Wigfield et al., 2006). Lower secondary school students, in particular, have repeatedly been shown to describe experiences in lessons that lead to disaffection and alienation (Skinner & Pitzer, 2012). However, other characteristics may also influence the engagement of lower secondary students.

Student engagement studies have shown that girls typically report higher behavioural (e.g. persistence and effort in learning), emotional (e.g. liking for learning and school) and cognitive (e.g. use of meaningful information processing strategies in learning) engagement than boys (Lam et al., 2016). Such results may be due to girls typically valuing school more than boys do in their planning, study management, and persistence (Martin, 2007). Girls also typically have a higher willingness to adopt the school's norms and rules (Eccles & Roeser, 2011). Boys, by contrast, are shown to be less positive about school and to see their homework as less useful (Rowe & Rowe, 1999).

Previous research also found an association between academic achievement and student behavioural, emotional, and cognitive engagement (Fredricks et al., 2004). High-achieving students reported greater behavioural engagement with school, which was expressed through factors such as effort in schoolwork and attention in class, than low-achieving students (Virtanen, Lerkkanen, Poikkeus, & Kuorelahti, 2014; Wang & Fredricks, 2014). The findings are in line with those indicating that academic achievement is related to task-focused behaviour (Onatsu-Arvilommi & Nurmi, 2000) and facilitates interest in different school subjects (Viljaranta, Tolvanen, Aunola, & Nurmi, 2014). Together these results indicate that high academic achievement is an important moderator of engagement experiences.

1.2 Intra-Individual Variation in Engagement

While the importance of student engagement in learning has been demonstrated in numerous studies, knowledge is still lacking concerning the processes of engagement on a micro level. To study this, more detailed process-oriented information is needed on aspects of student engagement over short time intervals using frequent measurement occasions (Hamaker, 2012). Such studies have received increasing interest among engagement researchers during the last few years because the resulting data maximizes contextual closeness and minimizes retrospective reporting and its associated problems (Wilhelm, Perrez, & Pawlik, 2012). These recent studies have added to our understanding of engagement by providing evidence of substantial intra-individual variability in engagement experiences from one lesson to the next (Pöysä et al., 2018; Shernoff et al., 2015).

Despite a growing number of studies focusing on the intra-individual variation of different components of engagement, several novel research questions have not been answered. One significant question asks to what extent different engagement experiences in a lesson have an effect on the following lesson. This is important to educators because for any intervention concerning students' engagement experiences, they need to know to what extent students' experiences are self-sustaining, or stable, from lesson to lesson in a context where both the teacher and academic content changes. Is each lesson a fresh start for students if the studied content and the teacher changes or is there is some stability from lesson to lesson? If the latter is true, teachers need to be aware of the potentially lasting effects of students' positive or negative experiences. It would also be important to know whether support in one engagement component can have an effect on another component. The effect can be "self-enhancing" or positive, such as a teacher supporting behavioural engagement leading to enhanced emotional engagement. The effect can be also "self-diminishing" or negative,

such as a teacher supporting emotional engagement leading to diminishing disaffection. Thus, there is a need to investigate stability and dynamics in these processes over time and answer questions regarding, for example, how emotional engagement in one lesson could predict disaffection in the following lesson.

Such research requires process-oriented data that includes chronologically ordered situations, that is, variables at time t and lagged variables at time $t+1$. However, to the best of our knowledge, only a few studies have examined learning experiences in lesson situations using chronologically ordered data. In their multivariate time-series analysis, Schmitz and Skinner (1993) reported significant individual differences in how students' perceived control of their schoolwork in one situation predicted perceptions and behavioural engagement (operationalised as "effort") and academic performance in a subsequent situation. The case studies showed individual differences in both lagged (auto-regressive, e.g., control at time t and $t+1$) and cross-lagged relationships between control and effort (control at time t and effort at time $t+1$). The study demonstrated the importance of considering the temporal dynamics of learning experiences at both the inter-individual and intra-individual levels of analysis.

Some years later, Musher-Eizenman et al. (2002) also focused on students' perceptions of control over their school tasks and academic achievement and the pooled and lagged analyses showed that students' learning experiences from one situation to another can vary much more than mean-level analyses of experiences show. Their results also indicated that students' school achievement might be an important determinant of learning experience stability. The stability of experiences from a previous situation to a subsequent one was stronger and more systematic for high-achieving students than for low-achieving ones.

Finally, in a recent study focusing on students' motivation (autonomous and controlled), behavioural engagement (effort exertion), and competence beliefs, Malmberg and Martin (2019) found that behavioural engagement (operationalised as effort) and competence beliefs did not show stability from one lesson to the next during school days, but did affect some other experiences. For example, high effort in one lesson diminished controlled motivation in the following lesson, although the subject changed. Together, these studies indicated that educators need to be aware of the potential lasting effect of each learning experience that takes place during lessons. Consequently, we focused on examining whether behavioural and cognitive engagement, emotional engagement, and disaffection in one lesson had an effect on the next lesson.

1.3 Present Study

We examined the intra-individual stability in different components of engagement experiences from one lesson to the next. We posed two research questions:

1. To what extent are students' engagement experiences, in terms of behavioural and cognitive engagement, emotional engagement, and disaffection, stable from one lesson to the next (autoregressive cyclic effects)?
2. What are the cross-lagged relationships (dynamic effects) between assessed engagement experiences from one lesson to the next?

Based on previous studies examining learning experiences in lesson situations using chronologically ordered data (Malmberg & Martin, 2019; Musher-Eizenman et al., 2002; Schmitz & Skinner, 1993), we assumed that there might be intra-individual stability in different engagement experiences from one lesson to the next (Hypothesis 1) and that the experiences may effect each other (Hypothesis 2). It has been suggested that considering moderation effects is important after establishing auto-regressive and cross-lagged paths

(Hamaker, 2012). Although previous studies have repeatedly indicated higher student engagement among girls than boys (Lam et al., 2016; Wang et al., 2011) and among high-performing students than low-performing ones (Virtanen et al., 2014), less is known about the possible moderating role of gender and achievement level on individual differences in lagged and cross-lagged effects of engagement. In one previous study, Musher-Eizenman et al. (2002) found that the stability of learning experiences from lesson to lesson was stronger for higher achieving students. In this study, we tested whether individual differences in lagged and cross-lagged effects might be associated with the gender of the student and with their achievement level. Musher-Eizenman et al. (2002) is the only study indicating the association of achievement level with stability of learning experiences and no study has examined whether lagged and cross-lagged effects are associated with gender, so we did not set hypotheses for these.

2. Method

The present study sample consisted of 56 Grade 7 students, 24 girls and 32 boys, in four classes at two lower secondary schools. The students took part in a one-week intensive lesson-to-lesson follow-up in spring of 2014 as part of a prospective longitudinal age cohort study (First Step study; Lerkkanen et al., 2006-2016), in which approximately 2,000 students were followed from the pre-primary level to the end of comprehensive school. The main aim of the larger longitudinal study was to investigate the development of the students' academic performance and motivation from the beginning of kindergarten to the end of lower secondary school. The sample was recruited from four municipalities around Finland; two from Central Finland, and one each from Western and Eastern Finland.

The schools participating intensive follow-up study were located in two municipalities in different parts of Finland: Two medium-sized schools (about 400 students) located in Central and Western Finland. The schools were chosen based on three criteria: 1)

being located in different parts of Finland, 2) being of similar size and good examples of typical Finnish schools, and 3) having a school principal that was willing to enable the intensive data collection. For more details see Pöysä et al. (2018).

Parents provided informed consent for their child's participation. All students with parental consent from four classes in these two schools participated in the study. The students' average age was 13.12 years ($SD = 0.26$). The sample was representative of the Finnish population with respect to the distribution of maternal education (Statistics Finland, 2018). In the sample, the educational level was low for 7.3%, medium for 73.2%, and high for 19.5% of the mothers. All participating students attended general education and all of them were Finnish speaking. The participating students in each school rated their engagement experiences using electronic questionnaires on smartphones at the end of each lesson during one school week (five days). In School 1, 45 students in three classes (Class A, 15 out of 18; Class B, 14 out of 16; and Class C, 16 out of 19 students) participated and filled out a questionnaire at the end of 30 total lessons during one school week. In School 2, one class (Class D, 11 out of 24 students) participated and these students filled out a questionnaire at the end of 23 total lessons during one school week. The total number of lessons was smaller in School 2 than School 1 because some of the teachers in School 2 did not agree to allow student ratings of situational engagement in their lessons, and students could therefore only rate a maximum of 23 lessons. Altogether, 34 teachers were involved in the intensive follow-up study.

Participating classes were selected based on two criteria. Priority was given to classes in which 1) a large proportion of the students were participants in the larger longitudinal follow-up, and 2) a large proportion of the subject teachers accepted the intensive data collection. The subsample of the present study represented the larger sample well in terms of student engagement. This sample's study did not differ from the larger

sample in terms of students' achievement level, parents' educational level or the educational level or work experience of teachers.

The smartphones were handed out to each student at the end of each lesson and the application that the students used was preprogrammed. The students filled out the questionnaire in approximately two to three minutes, after which the smartphones were collected; a similar procedure was used by Malmberg, Woolgar, & Martin, 2013. The number of ratings available for each student varied depending his or her attendance at school during the intensive follow-up study. In Class 1, students rated their experiences an average of 24.1 times ($SD = 3.1$, range 17–28); in Class 2, an average of 25.9 times ($SD = 4.26$, range 19–30); in Class 3, an average of 24.0 times ($SD = 6.7$, range 8–30); and in Class 4, an average of 17.7 times ($SD = 5.2$, range 5–23). The response rate was 81.8% and the intensive follow-up study contained a total of 1,328 ratings. After inspection of the time-stamped data, we excluded retrospective reports of lessons, and only ratings with a sequence of 1 hour were included; therefore, total of 975 ratings were included in the present study. In this sample, each student rated an average of 17.4 lessons ($SD = 5.67$, range = 2–25).

2.1 Education in Finland

In Finland, compulsory comprehensive school starts when students turn seven and continues until they are 15. Grades 1–6 are primary school and Grades 7–9 (ages 13–15) are lower secondary school. During lower secondary school, students are taught by subject teachers. At the beginning of Grade 7, students are grouped into home classes and remain in those groups until the end of lower secondary school. Students mainly stay in one group and the teacher changes for each lesson. Students attend approximately 30 lessons a week, typically seven lessons a day. Lessons are usually 45 minutes long with a 15-minute break between lessons.

2.2 Measures

2.2.1 Engagement experiences. Students' engagement experiences during the lessons were assessed with In Situations (InSitu) Instrument (Vasalampi et al., 2016). InSitu consists of 17 items that assess students' concentration on tasks, pleasures and displeasures during the lesson, how competent they felt, and help-seeking. Students rated the items on a five point scale (1 = not at all, 5 = very much). The following three dimensions were evaluated in this study: Behavioural and cognitive engagement (seven items), emotional engagement (three items) and disaffection (three items). All items included in these dimensions are presented in Table 1.

The reliability of the scales, which were single-level models that included both intra-individual and inter-individual variations, were evaluated using McDonald's omega (ω), factor score determinacy coefficients, and Cronbach's alpha (α). The results of these analyses were consistent, suggesting that all scales were reliable: Behavioural and cognitive engagement: $\omega = 0.93$, factor score determinacy coefficient = 0.95, $\alpha = .83$. Emotional engagement: $\omega = 0.89$, factor score determinacy coefficient = 0.95, $\alpha = .85$. Disaffection: $\omega = 0.80$, factor score determinacy coefficient = 0.87, $\alpha = .68$. Multilevel confirmatory factor analysis (time points nested in students) supported the structural validity of the constructs at both levels of data (Vasalampi et al., 2016, Pöysä et al., 2018).

2.2.2 Academic achievement. The measure of academic achievement was the students' grade point average from Grade 7. Information was taken from the school registers.

2.2.3 School subject. Rated lessons included 15 different subjects: Language arts (Finnish), Mathematics, English (as a foreign language), Swedish (as a second national language), Biology, Geography, Physics, History, Health Education, Religion, Home Economics, Visual Arts, Music, Physical Education, and Crafts (design and technology). In this study, the school subject was controlled for as follows: 1 = Languages (Finnish, English, and Swedish), 2 = Science (Mathematics, Biology, and Physics), 3 = Humanities (History,

Geography, Health Education, Religion), and 4 = Nonacademic subjects (Home Economics, Visual Arts, Music, Physical Education, and Crafts).

2.2.4 Gender. Gender was categorized as 0 = girl and 1 = boy.

2.3 Statistical Analyses

Analyses were conducted using the Mplus statistical package (version 7.3, Muthén & Muthén, 1998–2017). The parameters of the models were estimated using the Bayesian estimation. The Bayesian estimation is suitable for models in which researchers (a) do not rely on a large sample theory requiring Maximum Likelihood or (b) test complex models (Muthén & Asparouhov, 2012). The data points were assumed to be missing at random (MAR). As indicators of model fit, we used the deviance value (*DIC*) and estimated number of parameters (*pD*); the strength of the associations was examined with Bayesian credibility intervals. Deviance value is a Bayesian generalization of the AIC and BIC which draws on ML estimation, and therefore, a model with a small DIC value is preferred (Muthén, 2010).

The analyses were carried out using dynamic structural multilevel modeling. In the multilevel analyses, a statistical model with two levels was specified. At the within-level, we estimated variation *within* individuals (between lessons) while at the between-level, we estimated variation *between* individuals. At the within-level, we examined whether students' engagement in a lesson (y_{t+1}) was predicted (using the regression coefficient β) by their engagement in the previous lesson (y_t). To do this, we specified a lagged variable of lesson-specific engagement (y_{t+1}) based on the concurrent lesson-specific engagement (y_t). In this context, the data was reorganized so that the first lesson of each day was not predicted by the last lesson of the previous day. This was achieved through setting the lagged (y_{t+1}) variable to be missing in the last lesson of the day. The time points during each day were assumed to be equidistant. The lag between timestamps was one hour.

Then, the models with random slopes were utilized to examine lagged (cyclic effect) and cross-lagged (dynamic effect) relationships between lessons and the individual differences in these effects. First, we examined the stability in each engagement dimension (behavioural and cognitive engagement, emotional engagement, and disaffection) separately (i.e., lagged effects from one lesson to the next). Cross-lagged paths from one engagement dimension to another were then added to the previous model to examine lagged relations between all the factors simultaneously. Random slopes were not allowed to correlate with intercepts at the *between-level* because of the small number of clusters (students). Finally, we added covariates.

At the *within-level*, we included the following school subjects as dummy-coded covariates: (1) Languages, (2) Science, (3) Humanities, and (4) Nonacademic subjects. Nonacademic subjects was a reference group and the others were dummy-coded. We also added a day of the week as a covariate at the within-level. At the *between-level*, we predicted individual differences in slopes with class, because the students were nested in classes, gender, and academic achievement. All continuous variables in the models were standardized ($M = 0$, $SD = 1$) to make them comparable. The variables were standardized with data that included within-level and between-level variation, and therefore, the total standard deviation (within + between levels) was one.

3. Results

3.1 Descriptive Analyses

As a first step, the correlations between engagement experiences (y_t variables) in within- and between-levels were analyzed (Table 2). Next, we analyzed the correlations between the (y_t) and (y_{t+1}) variables at the within-level (Table 2). Finally, we examined the variation in students' lesson-specific engagement. The intraclass correlations ranged from .23

to .41 (Table 3). While the bulk of the variance (more than half) was at the within-level, between-level variance was sufficient enough to warrant multilevel analysis.

3.2 Stability of Engagement Experiences

To examine the stability in component of students' engagement experience from one lesson to the next, separate lagged models with random slopes were carried out for each engagement dimension (Table 4). The model fit indices were as follows:

Behavioural/cognitive engagement: $DIC = 2375.45$, $pD = 69.89$; emotional engagement: $DIC = 2446.01$, $pD = 67.18$; disaffection: $DIC = 2265.30$, $pD = 69.28$. The results supported hypothesis one and showed statistically significant stability from one lesson to the next with regard to behavioural and cognitive engagement, emotional engagement, and disaffection. All of these stabilities varied between individuals and variance terms for random slopes are included in Table 4.

3.3 Dynamic Effects Between Engagement Experiences

Dynamic effects or the cross-lagged relations between all engagement experiences were examined after controlling for the lagged effects of each construct. To study this, four models were created: Model 1 comprised behavioural/cognitive engagement and disaffection, and Model 2 was the same but with between-level predictors included. Model 3 comprised emotional engagement and disaffection as did Model 4, with between-level predictors included. Behavioural/cognitive engagement and emotional engagement were not used in the same model because descriptive analyses indicated a collinearity between these factors. School subject was excluded from the final model because it was not a significant predictor. Thus, only day of the week was controlled for in final models.

The model fit indices for Model 1 were as follows: $DIC = 4551.85$, $pD = 165.88$. The results pertaining to this model (Fig. 1) showed one significant cross-lagged path across the whole sample; a high level of behavioural and cognitive engagement in a lesson predicted

less disaffection in the subsequent lesson. Thus, hypothesis two, which assumes cross-lagged relations between different engagement experiences, was partially supported in this model.

The results also showed that the variances of all the lagged and cross-lagged slopes were statistically significant with variances ranging from .016 to .057, suggesting individual differences in all of the tested effects. Therefore, we conducted further analyses in which individual differences in the lagged and cross-lagged slopes were predicted with students' class group, level of academic achievement, and gender ($DIC = 4544.75$, $pD = 163.90$). Class did not predict any of the slopes and was excluded from the final model. The final analyses for Model 2 indicated (Fig. 1), first, that gender predicted variance in a cross-lagged effect of disaffection on behavioural and cognitive engagement in the next lesson. Among girls, higher disaffection in a lesson increased their behavioural and cognitive engagement in the subsequent lesson [$\beta = .15^*$], but among boys, a higher disaffection in a lesson decreased their behavioural and cognitive engagement in the subsequent lesson [$\beta = -.14^*$]. Students' achievement or gender did not significantly predict variance in any other slopes but it was observed that the higher the level of the achievement was, the lower the level of disaffection was (Fig.1).

The model fit indices for Model 3 were as follows: $DIC = 4508.60$, $pD = 169.26$. The results of the model indicated that none of the cross-lagged paths were significant across the whole sample. Disaffection in a lesson did not predict emotional engagement in the subsequent lesson or vice versa (Fig. 2). Thus, hypothesis two was not supported in Model 3. However, the results showed statistically significant individual differences (variations) in all slopes included in the model, with the variation ranging from .016 to .058. The class did not predict any of the slopes and was excluded from the final model. The results for Model 4 showed that academic achievement significantly predicted stability of disaffection (Fig. 2). The higher the level of the students' achievement, the more stable disaffection was from

lesson to lesson. Gender did not predict individual differences in lagged or cross-lagged paths. As evidenced in Model 2, the higher the level of the achievement was, the lower the level of disaffection was.

4. Discussion

In this study, process-oriented analyses were conducted to examine components of lower secondary school students' engagement experiences and the stability of those experiences from one lesson to the next. Our models go beyond previous intra-individual models by examining engagement processes with chronologically ordered data, which opens up the possibility of studying cyclic (self-sustaining) effects and dynamic (self-enhancing and self-diminishing) effects between engagement dimensions over time at the individual level. Two main findings on these effects emerged. First, the results indicated that experiences of behavioural and cognitive engagement, emotional engagement, and disaffection showed some sustainability from one lesson to the next after controlling for the school subject. Second, experiences of behavioural and cognitive engagement showed a self-diminishing effect on disaffection.

Our results showed a small significant stability coefficient in behavioural and cognitive engagement, emotional engagement, and also in disaffection from one lesson to the next, although the teacher and subject content could be different. This finding is in line with the results of previous process-oriented studies that indicated that a lagged effect might be present in a student's learning experiences from one situation to another (Malmberg & Martin, 2019; Musher-Eizenman et al., 2002; Schmitz & Skinner, 1993). These studies are important because they examined learning experiences between situations in cases of individual students, which makes conclusions about processes at the individual level possible.

It is possible that different school lessons are not entirely separate and disconnected from one another at the individual level, but learning experiences during each lesson have

effect on subsequent learning experiences. However, it is also possible that such intra-individual stability is particularly significant in school systems like that of Finland, where a class (home group) of students stays relatively intact despite the teachers changing. Therefore, in some sense, a student's context remains the same although the teacher and subject content changes, which may have contributed to the significant stability from one lesson to the next. Students in a particular class may have high levels of emotional engagement experiences from lesson to lesson regardless of the teacher because of the supportive atmosphere created by classmates (see e.g., Mainhard, Oudman, Hornstra, Bosker, & Goetz, 2018). Future studies could be designed with this in mind. It is also important to note that the effect sizes in stabilities were rather small. We controlled for class and day of the week for the analyses but it is possible that there are some other dependencies in the data that we were not able to take into account. For example, stabilities in experiences may depend on the specific moment of the day or the mood of the participating students during the week when data was collected. The results need to be replicated before they can be generalized.

Our analyses also revealed one significant cross-lagged relationship (dynamic effect) between the assessed engagement experiences from one lesson to the next. Higher experiences of behavioural and cognitive engagement in a particular lesson predicted diminished disaffection in the following lesson. Although the effect size of the finding was small, it is in accordance with the results found at the inter-individual level by Skinner et al. (2008), showing that behavioural engagement in a lesson is not important only for the present lesson, but might also be important for supporting other components of engagement in subsequent lessons. Our process-oriented data indicated the possibility that active participation and focus on classroom activities diminishes disaffection in the following lesson regardless of the topic of the first lesson.

Encouraging behavioural and cognitive engagement in order to prevent disaffection might be particularly important among lower-achieving students. Our results showed that there was more fluctuation in students' disaffection from lesson to lesson the lower their achievement level was, and also that there were mean-level differences in disaffection depending on students' achievement level. The higher the level of the students' achievement, the lower the level of their disaffection. In other words, the less the student was achieving, the more they experienced negative emotions and the less they focused on the learning objectives of the lesson. These results are in line with previous ones indicating that low achievers use maladaptive learning strategies more often than high achievers do, which is likely to form a negative developmental cycle regarding academic skills (Onatsu-Arvilommi & Nurmi, 2000).

Gender significantly predicted differences between individuals in only one cross-lagged relationship in a model comprising behavioural and cognitive engagement and disaffection. The cross-lagged effect of disaffection on behavioural and cognitive engagement was dependent on gender; the effect was positive among girls but negative among boys. One explanation for this result is that girls are more likely than boys to seek support from their teacher and peers when they are disaffected (McNelles & Connolly, 1999). Therefore, teachers and peers respond to them in affective and supportive ways and so disaffection has a self-enhancement effect on behavioural and cognitive engagement among girls. However, gender did not predict any other estimated lagged or cross-lagged effects. The effect size for the significant result was also small. Therefore, one might conclude that according to the findings of the present study, the stabilities of engagement experiences from lesson to lesson are not entirely different for girls or boys. However, these findings should be replicated with a larger sample before generalization.

4.2 Limitations

The limitations of the current study should be taken into account. The high correlation between behavioural and cognitive engagement and emotional engagement prevented examination of the association between those two engagement dimensions. Barber et al. (2017) found that high emotional engagement predicted high behavioural engagement, but not vice versa. It would be important to examine this topic in more depth with chronologically ordered data, as used in this study. However, the measures should differentiate emotions from behavioural aspects more than was possible in the present study. Developing new measures that are able to distinguish different components of engagement is one of the most important issues in the field of engagement research. The problem is not related only to process-oriented measures, but to all measures used in the field. The difficulty comes from the fact that although different components are theoretically clearly separate and meaningful constructs, there are always emotional aspects in cognitions, cognitive aspects in emotions, and the links between cognitive and behavioural engagement previously discussed in the introduction of this study.

In this study, behavioural and emotional engagement were found to be highly correlated on both the between-individuals and between-lessons, that is, within-individuals, levels. Thus, students who were persistent, concentrated, and invested effort into the lessons were also feeling positive emotions across them. Moreover, concentrated and persistent behaviour during a particular lesson correlated to high positive emotional engagement on that same lesson. This suggests that in a given lesson, students do not distinguish significantly between different components of engagement experiences. Similar results have also been suggested for learning experiences focusing on motivation. For example, Dietrich et al. (2017) showed that in a given situation, at the individual level, students did not significantly distinguish between different facets of expectancies or their values (intrinsic, attainment, and utility) for the lesson.

Students rated their lesson-specific engagement experiences only once, at the end of a lesson. There might have been a lot of variation in students' engagement during the lesson, but, because of our study design, we were not able to evaluate it. In future studies it would be important to find ways to capture engagement at the moment they occur during a lesson. This would provide a more accurate estimate of lesson-specific engagement.

It is also important to note that although our data included 975 ratings from one school week, it was very limited in that it only included 56 students from two schools. It is possible that the small sample caused some of the limitations mentioned above; the analyses should be replicated with larger data before generalizing the results.

4.3 Conclusions

In the present study we used temporal data to examine the lagged and cross-lagged effects of engagement experiences from one lesson to the next. Our study expands on previous studies by showing the small significant sustainability of students' experiences of engagement from one lesson to the next, regardless of the subject studied or teacher continuity. Finally, higher experiences of behavioural and cognitive engagement in a lesson also helped prevent disaffection in the subsequent lesson.

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Table 1.

Items of the InSitu Instrument.

1. Behavioural and cognitive engagement (seven items)
Beh/Cogn 1. How important did you find the studied contents?
Beh/Cogn 2. How much did you try to act according to the teacher's wishes?
Beh/Cogn 3. How much did you invest effort into making the teacher pleased with you?
Beh/Cogn 4. To which extent were you prepared for the lesson?
Beh/Cogn 5. How well did you concentrate during the lesson?
Beh/Cogn 6. How persistent were you in studying during the lesson?
Beh/Cogn 7. How much did you plan your tasks ahead instead of just doing them right away?

2. Emotional engagement (three items)
Emo 1. How much did you like this lesson?
Emo 2. How pleasing did you find the studied tasks?
Emo 3. How enjoyable was the lesson?

3. Disaffection (three items)
Disaff 1. How much did you do other things than the ongoing tasks and instruction?
Disaff 2. How tired did you feel during the lesson?
Disaff 3. How boring was the lesson?

Note. Rated using a 5-point scale: 1 = not at all to 5 = very much

Table 2.
Correlation Matrix for Situation-Specific Engagement for (y_t) and (y_{t+1})
(variables at the within-level)

Engagement dimension	1	2	3	BEHCOGN (y_{t+1})	EMO (y_{t+1})	DISAFF (y_{t+1})
1 BEHCOGN (y_t)	1.00	.87***	-.29**	.22***	.21***	-.20***
2 EMO (y_t)	.90***	1.00	-.43***	.19***	.22***	-.17***
3 DISAFF (y_t)	-.43***	-.46**	1.00	-.07	-.09	.18**

Note. BEHCOGN = Behavioural and cognitive engagement, EMO = Emotional engagement, DISAFF = Disaffection, (y_t) = previous lesson, (y_{t+1}) = subsequent lesson. Correlations above the diagonal are for the within-level (between lessons within students) and below the diagonal are for the between-level (between students) occurrence. *** $p < .001$, ** $p < .01$

Table 3.
Intra-Class Correlations Within and Between the Individuals

	Behavioural and cognitive engagement	Emotional engagement	Disaffection
ICC _{within} individuals	.69***	.77***	.59***
ICC _{between} individuals	.31***	.23**	.41***

Note. *** $p < .001$, ** $p < .01$

Table 4.
Stability of Each Engagement Dimension from One Lesson to the Next and Differences Between Individuals in the Stabilities

	Stability			Difference between individuals (Random Slope)		
	β	<i>posterior s.e.</i>	<i>credible interval</i>	<i>var</i>	<i>posterior s.e.</i>	<i>credible interval</i>
BEHCOGN	.21	0.05	0.10–0.32	.07	0.03	0.03–0.14
EMO	.22	0.06	0.12–0.33	.08	0.03	0.04–0.15
DISAFF	.21	0.05	0.12–0.29	.04	0.02	0.01–0.09

Note. BEHCOGN = Behavioural and cognitive engagement, EMO = Emotional engagement, DISAFF = Disaffection. Each dimension was examined as one separate model.

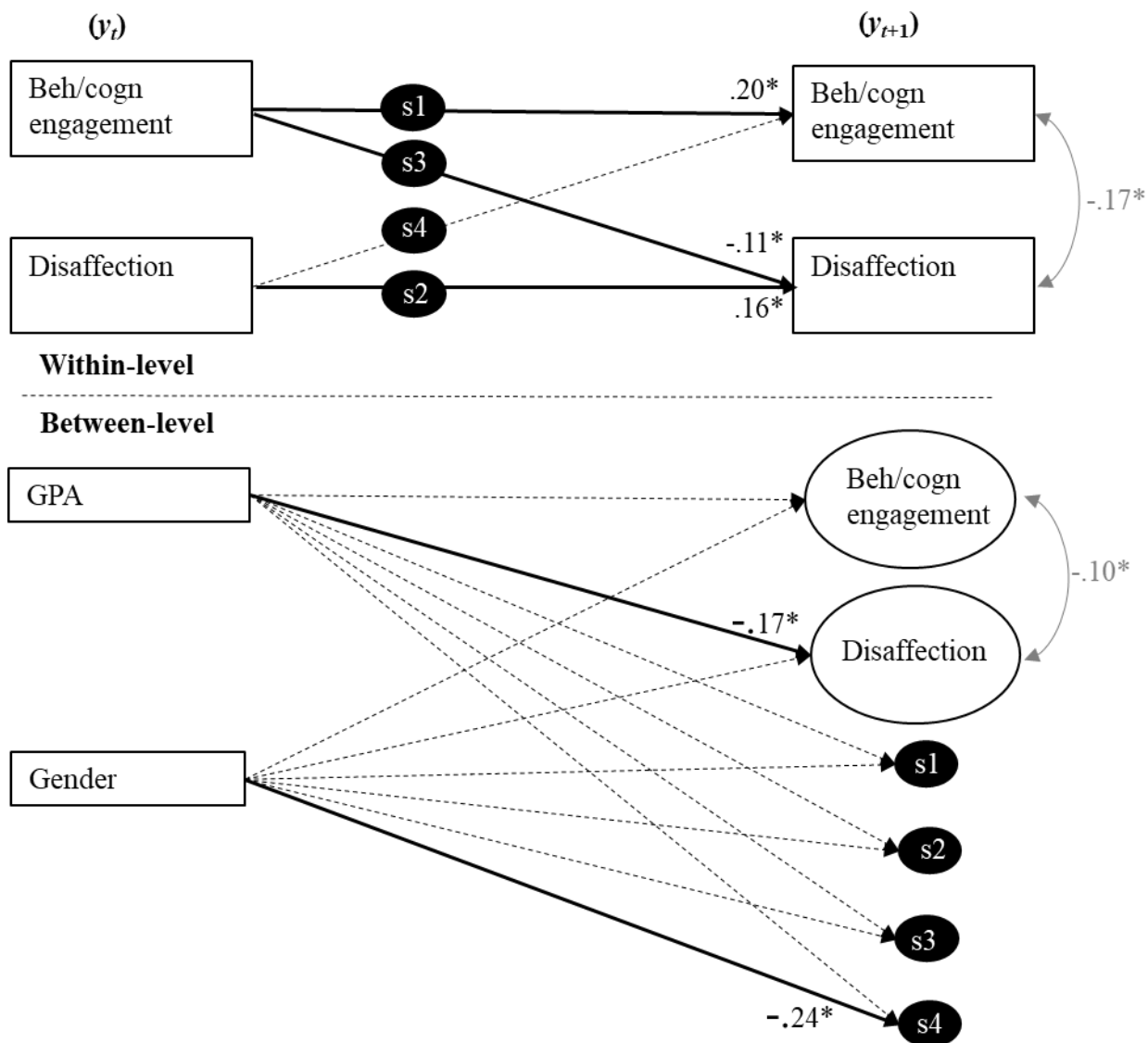


Figure 1.

Results of the multilevel random slope model for behavioural and cognitive engagement and disaffection.

Note. Estimates are standardized at the level of the whole sample. *s* = random slope; * = significant with 95% confidence level; dotted line = non-significant.

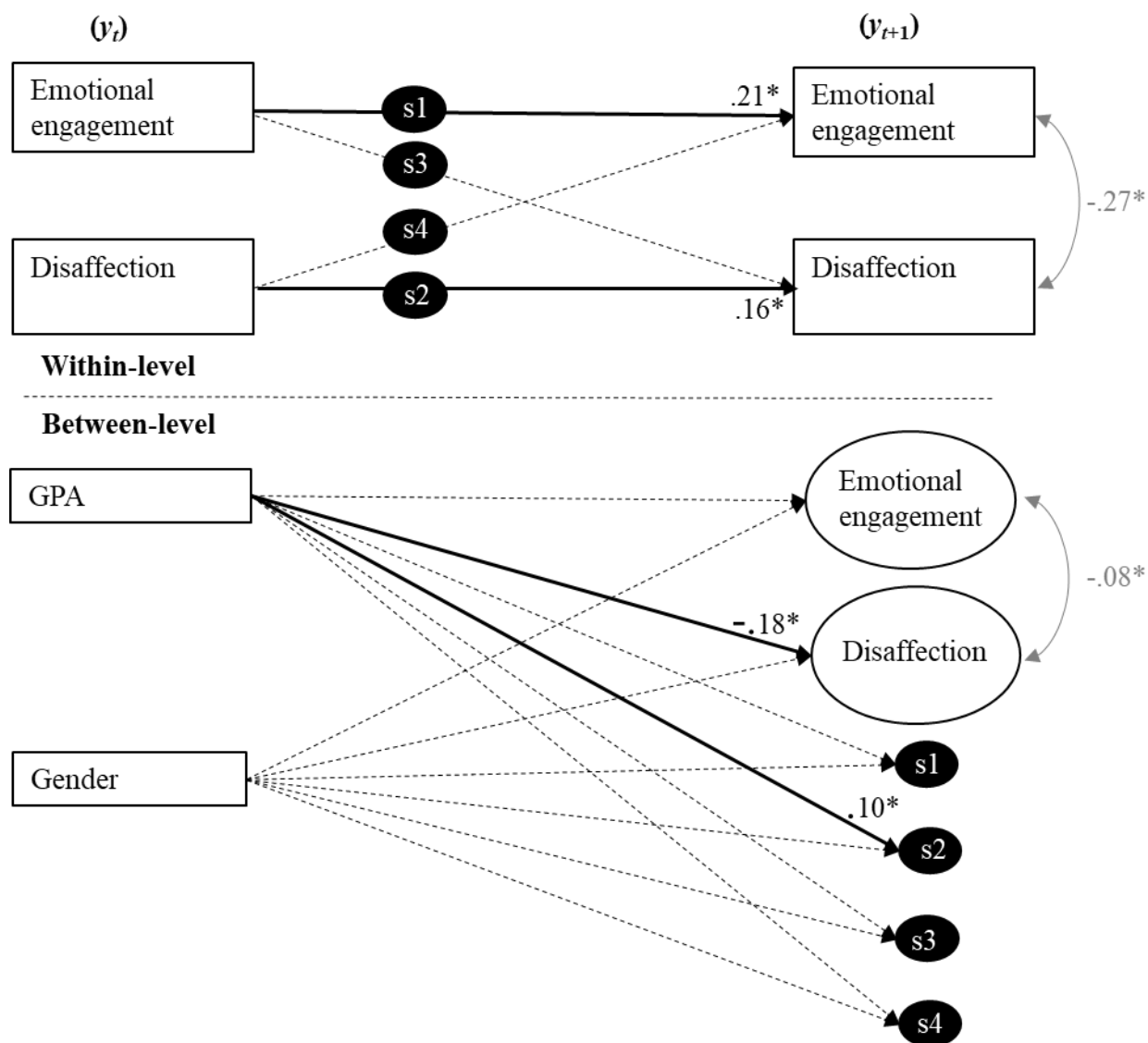


Figure 2.

Results of the multilevel random slope model for emotional engagement and disaffection.

Note. Estimates are standardized at the level of the whole sample. s = random slope; * = significant with 95% confidence level; dotted line = non-significant.