Interplay of internal and external regulation and their joint impact on student engagement in class

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Abstract

Student engagement in class is the time during class when students are actively and productively learning in regard to specific scholastic content (Doyle, 1986, 2006; Kubany & Sloggett, 1973; Ryan, 2000; Shapiro, 2013; Spanjers et al., 2008). Educational scientists agree that student engagement is a substantial predictor of academic performance (Finn et al., 1995; Hattie & Anderman, 2013; Lundervold et al., 2017). Nevertheless, factors influencing student engagement in elementary school have not been investigated systematically (Godwin et al., 2016). Accordingly, this dissertation examines individual, social, and instructional factors which might impact elementary students' engagement during class.

The sample used consists of 34 fifth grade elementary school classes in Switzerland. A unique feature of this project is that data from the same students was collected during classes in many subjects taught by different teachers. The data used in this dissertation was collected using three instruments: First, a longer questionnaire about attributes of the students which are conceptualized as more stable (e.g., socio-economic status, class friendships, trait self-control, trait motivation, trait engagement, perceived engagement of classmates). Second, a standardized observation of students' on-task engagement employing a 15-second time-sampling approach. Third, a short student questionnaire after each observed lesson capturing the student's self-perception during the lesson (e.g., state self-control, state motivation, state engagement).

The data analysis strategy follows a quantitative approach, taking into account dependencies between students from the same classroom. The results indicate that both internal regulation and external regulation play an important role in regard to student engagement in class. Self-control and different types of intrinsic and extrinsic motivation have important impacts on student engagement in class.

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1 Introduction

The present dissertation investigates student-related factors affecting student engagement during class in elementary school. Factors influencing student engagement in elementary school have not been investigated systematically (Godwin et al., 2016). Nevertheless, student engagement in class has high relevance in the school context. On the one hand, student engagement affects elementary students' future academic achievements. Educational scientists agree that student engagement has a substantial impact on academic performance (e.g., Finn et al., 1995; Hattie & Anderman, 2013; Lundervold et al., 2017). Additionally, the level of student engagement might predict the likelihood of a student dropping out of secondary school (Janosz et al., 2008). On the other hand, student engagement is also relevant to teacher wellbeing. Teacher burnout has been associated with a lack of student engagement in class in many studies (e.g., Baeriswyl-Zurbriggen et al., 2014; Hakanen et al., 2006; Wettstein et al., 2021). Accordingly, student engagement in class is a central but understudied aspect of learning and teaching in elementary school worth investigating further.

By investigating student engagement, the present dissertation focuses on three guiding research questions. Research question one investigates the relationships between the three different measures used to triangulate student engagement during class. Within the range of this question it is examined, for example, whether observer ratings of student engagement in class predict students' retrospective self-perceptions of their engagement during class, and whether class membership affects how students perceive their own engagement. Research question two looks at the relationships between motivation, self-control, and state student engagement during class. More specifically, it is examined, firstly, how self-control and different types of student motivation affect student engagement during class and, secondly, whether self-control might moderate the effects of the different types of motivation on student engagement in class. Research

question three investigates student state engagement and state intrinsic motivation in regard to friendships and negative relationships in a class. Accordingly, research question three examines how the social relationships (or social network) of students in a class could affect their motivation and/or engagement in class. Within the range of this question it is, for example, examined whether friends in a class are similar in their motivation and/or student engagement.

The present dissertation is embedded in a larger project funded by the Swiss National Science Foundation called “Klassenteams” [Grant number: 162699, Applicants: Prof. Dr. Doris Kunz Heim & Prof. Dr. Franziska Vogt]. The sample used for the dissertation consists of 34 fifth grade elementary school classes in Switzerland. A unique feature of this project is that data from the same students was collected in many subjects taught by different teachers. The data used in this dissertation was collected employing three instruments: a longer questionnaire about attributes of the students which are conceptualized as more stable, a standardized observation of students’ on-task engagement, and a short student questionnaire after each lesson observed, capturing the student’s self-perception during the lesson. The data analysis strategy follows a quantitative approach, taking into account dependencies between students from the same classroom.

2 Theoretical background

In the current section, first, the conceptualization of student engagement in class is discussed. Second, different possible influences on student engagement are presented. Third, the theoretical working model for the present dissertation is presented.

2.1 Student engagement in class

According to Azevedo (2015, p. 84), "engagement is one of the most widely misused and overgeneralized constructs found in the educational, learning, instructional, and psychological sciences". The difficulties in defining student engagement can be seen in a recent systematic review of student engagement, which concluded that the "studies sampled showed inconsistency and variability in the SE [student engagement] conceptualizations used" (Martins et al., 2022, p. 806). In several conceptualizations, student engagement encompasses anything from participation in class to attendance at school-related leisure clubs (Fredricks et al., 2004). In contrast to that, the present dissertation focuses solely on participation in classroom activities. Skinner et al. (2009, p. 494) propose that most conceptualizations of student engagement agree that student engagement "captures the quality of students' participation with learning activities in the classroom". Accordingly, student engagement in class can be defined as the time during class when students are actively and productively learning in regard to specific scholastic content (Doyle, 1986, 2006; Kubany & Sloggett, 1973; Ryan, 2000; Shapiro, 2013; Skinner et al., 2009; Spanjers et al., 2008). Student engagement is often considered the same as 'attentiveness' and/or 'on-task behavior' (Helmke & Renkl, 1992). Nevertheless, as this dissertation focuses on student engagement as the main theoretical concept of interest, the terms 'attentiveness' and/or 'on-task behavior' are understood as parts of the overarching concept of student engagement, which is discussed in the following.

Student engagement is often defined as a multidimensional construct, combining behavioral, cognitive, and emotional engagement (Fredricks, 2011; Fredricks et al., 2004). Behavioral parts of engagement are "related to attendance, participation, and positive conduct", while cognitive engagement relates to "students' level of investment in learning", and, emotional engagement to the "extent of positive […] and negative [...] reactions to the school, teacher, and activities" (Fredricks, 2011, p. 328). While it seems to be reasonable to consider behavioral, cognitive, and emotional aspects of student engagement, this also poses a big challenge for the study and the conceptualization of student engagement. Reschly and Christenson (2012, p. 11) name this challenge the "jingle-jangle problem": "engagement currently suffers from a […] problem wherein the same term is used to refer to different things (jingle) and different terms are used for the same construct (jangle)". For example, Reschly and Christenson (2019, p. 11) mention that "perceived relevance, or utility, of school [was conceptualized by some authors] as affective engagement, whereas we [the authors themselves] would characterize it as cognitive engagement, while other authors conceptualize it as motivation". According to Sinatra et al. (2015, p. 8), this difficulty to "differentiate the dimensions [of student engagement] from one another" at least partly stems from intersections between the dimensions of student engagement. As a consequence, it is difficult, if not impossible, to measure dimensions of student engagement separately (Sinatra et al., 2015). Consequently, in this dissertation student engagement, in line with the proposed definition above, means student engagement as a whole, but in terms of the differentiation of dimensions, there is a focus on behavioral and, at least to a certain extent, also cognitive parts of engagement.

A further problem related to the conceptualizations of student engagement is that motivation is "often included in operational definitions of emotional engagement" (Sinatra et al., 2015, p. 2), or that researchers "use the terms engagement and motivation interchangeably", while others

clearly separate the two constructs (Reschly & Christenson, 2012, p. 14). The latter scholars posit that the "theoretical advancement of the constructs of engagement and motivation requires that the association between the two be clearly specified and tested" (Reschly & Christenson, 2012, p. 14). Consequently, clear separation of the two constructs is necessary. This proposition is further supported by Sinatra et al. (2015, p. 3), who fear that "engagement would be a less useful construct if the definition becomes too broad and too conflated with too many other constructs". Accordingly, in this dissertation, student engagement is conceptualized as a construct separate from student motivation. This is in line with a conceptual separation of motivational and behavioral processes (Ainley, 2012). For this dissertation, motivation and engagement are distinguished from each other in line with the proposition of Ainley (2012, p. 285): "Motivation is about energy and direction, the reasons for behavior, why we do what we do. Engagement describes energy in action, the connection between person and activity".

As such, it seems as if the relationship between motivation and student engagement could be consistent with conceptualizations of traditional goal setting theories of intended or planned behavior, in which motivational phases precede behavioral phases, such as the volition phase in the Rubicon model (Heckhausen & Gollwitzer, 1986; Heckhausen & Gollwitzer, 1987), or the behavior that evolves after the intention building phase in the theory of planned behavior (Ajzen, 1985, 1991; Ajzen & Fishbein, 1980). Nevertheless, this might only apply partly because engagement in class might not always be intentionally planned, but might be affected by situational and unconscious processes. Accordingly, these theories might only be able to explain student engagement partially. However, such theories might be helpful in planning intentional interventions for behavioral change together with a student. In section 2.2.1 below, other models including student engagement that contribute to an understanding of influences on student engagement will be discussed.

In the next subsections, the present dissertation's conceptualization of student engagement in class is further discussed.

2.1.1 Procedural and substantive parts of student engagement in class

While student engagement is related to some type of action, the related action might not always be fully observable. Accordingly, Spanjers et al. (2008) propose distinguishing two components of student engagement: procedural engagement and substantive engagement. Procedural engagement describes observable components of student engagement (e.g., students working on exercises and/or writing). Substantive engagement describes the non-observable component of student engagement (e.g., students reflecting on scholastic content).

Several authors divide procedural student engagement into 'on-task' and 'off-task' behavior (Doyle, 1986, 2006; Helmke & Renkl, 1992; Kubany & Sloggett, 1973; Shapiro, 2010). While on-task behavior describes all behavior corresponding to the teacher's behavioral expectations of a student, off-task behavior delineates behavior not corresponding to the behavioral expectations of the teacher. In this dissertation it is assumed that while at a specific moment during class a student might usually be performing either an on-task or an off-task behavior, the student's accumulated behavior over a whole lesson might vary on a continuum of (almost) all the time on-task to (almost) all the time off-task.

Prior observational studies indicate that students in regular classrooms spend most of the time in class displaying on-task behavior rather than off-task behavior. In a US study of kindergarten and elementary school students, Godwin et al. (2016) found an average rate of 70 percent on-task behavior. Helmke and Renkl (1992) found an average of 80 percent on-task behavior in fourth graders in German elementary schools with a range among students of 60 to 93 percent on-task behavior. Accordingly, in relation to the present study, which investigated regular fifth

grade classrooms, an average percentage of on-task behavior observed ranging between 60 and 90 percent was expected.

In contrast to procedural engagement, substantive engagement describes the non-observable component of student engagement (Spanjers et al., 2008; e.g., students reflecting on school contents). As this part of student engagement is not directly observable, any measurement of substantive student engagement has to rely on the subjective evaluation of the students themselves.

Although substantial student engagement is not observable, it constitutes an important part of student engagement during class and might partly be expressed through procedural engagement (e.g., a student's facial expression while reflecting on scholastic content). Consequently, student engagement during class most frequently consists of both procedural and substantial components of student engagement.

2.1.2 Observability of student engagement in class

The observability of student engagement in regard to procedural and/or substantial components is important when it comes to comparing different types of measures used in the investigation of student engagement.

On the one hand, self-assessment measurements (e.g., questionnaires and interviews in which people reflect on their own engagement) might be able to capture procedural and substantial parts of an engagement behavior. On the other hand, observational measurements (e.g., standardized observations through which a person's engagement is rated by another individual), and further other-person-assessed measurements (e.g., a teacher questionnaire or interview asking teachers to rate their students' engagement in class) might enable a more precise assessment of procedural parts of student engagement behavior than of substantial parts of student engagement, because substantial parts are not necessarily observable. It is therefore assumed that self-

assessed and other-person-assessed measurements of student engagement are positively related to each other. However, there might not be an exact correspondence between the two types of measurements.

Unfortunately, there are only very few empirical investigations that compare different types of measurements of student engagement (Knogler & Böheim, 2019). A study by Spanjers et al. (2008) in regard to self-assessment versus other-assessment of student engagement during class in elementary school (third and fourth grade students) found low correlations between an observational measurement and a self-assessment questionnaire measurement of student engagement in class. However, Spanjers et al. (2008) used a measure of 'effort and persistence' to operationalize student engagement, which might differ slightly from the conceptualization of engagement as 'time on task'.

Hypothesis 1a: Other-person-assessed measurements of student engagement in class are positively associated with self-assessed measurements of student engagement in class.

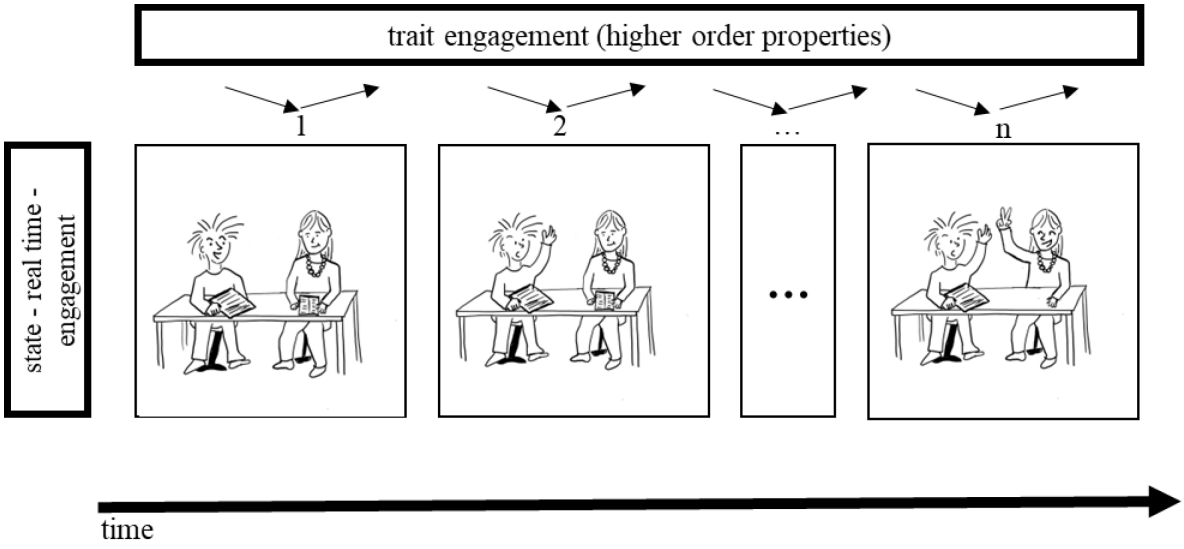
2.1.3 Stability of student engagement in class

In everyday life student engagement is often understood as a student's stable personal trait. Nevertheless, theoretical models of student engagement and a study of university students (Shernof et al., 2017) indicate that the engagement of a student might also vary in different situations. Consequently, while there might be a certain stability in a student's engagement behavior during class, there is still a certain variability in the student's engagement behavior expected when looking at different situations. This situational variability of student engagement is also referred to as state dependence of student engagement. This proposition is in line with other findings in psychology suggesting that "most psychological variables contain both state and trait components to varying degrees" (Geiser et al., 2017, p. 219). As such, state and trait

measurements of course are related to each other. Accordingly, 'trait student engagement' describing how a student usually participates in class, of course affects 'state student engagement' describing how a student acts in a certain situation in a specific class. Moreover, students' 'state engagement' in class might also affect their more stable 'trait engagement' in class in the longer term (see **Figure 1**).

Figure 1

Association between trait and state engagement in class.



Note 1. The figure was inspired and adapted from Fig. 3 of van Dijk (2021) depicting an "Illustration of iterativeness and the emergence of higher order properties in a child-caregiver system".

Note 2. The drawings of the students sitting at a table in class were drawn in the ipad app "Procreate" by the author of this dissertation. The drawings were inspired by the logo used in the research project "Klassenteams", of which this dissertation is a part (see http://www.klassenteams.ch).

In accordance with **Figure 1**, the metaphor of a movie is proposed. Firstly, movies can be categorized into different genres (e.g., action, drama, comedy). A movie in a specific genre generally includes certain characteristics associated with the genre related to the story, the plot, the characters, and the setting of the movie (Weingartner). For example, comedies are usually funny, easy-going, and have a happy ending. In comedies the characters are usually people with

normal characteristics and competences, living in a relatively normal environment. Accordingly, a general theme is related to a movie genre, and this might evoke certain expectations on the part of the viewer. Consequently, the genre of a movie affects how specific scenes in the movie – as parts of the movie – are built. While in general, the scenes might all be funny, it could be necessary to build in something sad or slightly scary in one scene to produce a funny twist in the next scene. Accordingly, not all scenes might be exactly in line with the genre, when looked at separately, but as a whole the movie still corresponds to the general genre of the movie. Similarly, trait engagement is, as discussed above, understood as the general engagement a student displays in class. Teachers perceive general behavioral patterns in class and categorize or describe students accordingly (e.g., Farmer & Farmer, 1996; Janosz et al., 2008). Student trait engagement could thus be understood, similar to a movie genre, as the general theme or perception of a student's engagement as a higher order property of a student's engagement, affecting a student's state engagement at a specific moment in class. As seen in **Figure 1**, state engagement might change momentarily depending on the class context. Nevertheless, an overarching pattern of engagement might be visible.

Measurements of student engagement behavior relating to a specific lesson in this dissertation are considered 'state' measurements, while measures relating to a longer period of time are considered 'trait' measurements. Of course, as such, the measures do not lie at the respective ends of the continuum of traits versus states, whereby a state might be understood as a momentary behavior and a trait might be understood as an inborn, never-changing behavior (Geiser et al., 2017). However, the terms state and trait, as they are used in this dissertation, might, nevertheless, be useful as indicators and/or reminders that one of the conceptualizations relates to a more stable part of student engagement behavior than the other.

In regard to state versus trait measurements of student engagement in elementary school specifically, no prior empirical investigations could be found. Nevertheless, there is one study that investigated the similarities between trait and state motivation using two different samples of eighth and eleventh graders (Götz et al., 2014). In their study, Götz et al. (2014) first examined how similar students from one sample generally judged their motivation in different subjects in general (trait characteristics). Second, they investigated with a second sample the motivation of students relating to a specific class in the same subjects. Third, the authors compared their findings on the trait and the state levels. They found an association between subject-related motivation and students' beliefs about subjects in the trait measure (sample one). With sample two, however, they did not find the same connection between motivation and belief among the various subjects. Accordingly, the authors argued that trait measures of motivation might be more closely related to students' attitudes about a school subject than state measures of motivation. While the study provides valuable insights into the relationship between trait and state emotions and motivation, it would of course be preferable if state and trait motivation had been assessed with the same students. Nevertheless, it is assumed that a measurement of trait student engagement predicts later measurements of state student engagement in class.

Hypothesis 1b: Measurements of trait student engagement positively predict following measurements of state student engagement in class.

Furthermore, in line with the above discussion as well as the finding of Götz et al. (2014), it is assumed that prior self-assessment measurements of trait student engagement are more closely related to self-assessment measurements of state student engagement than to other-assessment measurements of state student engagement. This is because self-assessments of state student engagement might be more closely related to students' appraisals of subjects than other-assessed observational measures of state student engagement during class. Accordingly, students

themselves might be able to rely on different types of information when judging their own behavior from those that observers use. A study by Skinner et al. (2009), whose findings are in line with this proposition, indicated that while teacher and student ratings of student engagement were moderately correlated, "scores from teacher reports, but not from student reports, were correlated with in vivo observations of engagement in the classroom, likely because teachers are also observers of student engagement" (Skinner et al., 2009, p. 517).

Hypothesis 1c: Self-assessments of trait student engagement better predict self-assessments of state student engagement than other-assessments of state student engagement do.

2.2 Influences on student engagement in class

In the present section, possible influences on student engagement in class are discussed. In a first step, models including student engagement as a mediator of student learning and/or achievement were summarized in regards to influences on student engagement. In a second step, possible influences on student engagement were drawn from a systematic literature review of empirical studies that investigated influences on procedural student engagement during class in elementary school (see documentation in Annexes A and B). In a third step, the findings in the theoretical models and the literature review are brought together into a first general theoretical framework of the interplay of internal and external regulation and their joint impact on student engagement in class. This was the foundation of the later theoretical working model for this dissertation.

2.2.1 Theoretical models including student engagement

Student engagement is often included in theories and models of the effectiveness of school lessons and/or models of student achievement. However, in most models, student engagement is only included as a mediator of student learning and/or achievement. The following models

of student learning and achievement that included student engagement as a central variable were considered in this dissertation:

- Fraser et al. (1987): Model of productivity for school learning;
- Helmke (2009): Offer-usage model of instruction;
- Krapp (1993): Model of learning motivation;
- Reeve (2012): Student-teacher dialectical framework within self-determination theory;
- Slavin (1994): QUAIT model of effective instruction.

The five models vary slightly in the broadness of their conceptualizations of student engagement, in regard to the inclusion of the different dimensions of student engagement (see **Table 1**).

Although trying to make a similar prediction, the models vary somewhat in the choice and categorization of the predictors of student engagement leading to student learning and/or achievement. Nevertheless, most of these models propose that individual aspects as well as social and instructional aspects influence student engagement in class (see **Table 1**).

In regard to the individual aspects influencing student engagement, the models mention characteristics relating to individual students and their personal backgrounds. Individual aspects in the models include socio-demographic characteristics, student development, languages spoken, prior knowledge, intelligence, student aptitude and ability, and a student's self-regulation, motivation, willingness to achieve, persistence, self-confidence, goals, values, attitudes, and learning and memory strategies (see **Table 1**).

The category of social aspects influencing student engagement in the models mentioned above includes aspects relating to a student's family and cultural background, such as the home of a student and mass media. This category also includes teacher-related aspects, such as the behavior and attitudes of the teacher. Additionally, aspects of the classroom, such as the peer group,

class composition, classroom climate, group dynamics and the social context, are also included in the models discussed. The model of Reeve (2012) summarizes all these aspects with the notion of 'relationships' (see **Table 1**).

In regard to instructional aspects affecting student engagement, most models include characteristics of the teacher and the instruction. Most of these models consider a teacher's perspective, focusing mainly on teacher behavior and a teacher's experience of the learning situation. In doing so, quantity and quality of instructional processes and teaching and learning materials, the didactical context, and the appropriateness of instruction, incentives and the teacher's motivational style are included. Krapp (1993), in contrast to the researchers who developed the other four models, takes a student focus in regard to instructional aspects of the learning situation, mentioning how interesting and difficult the object of learning is (see **Table 1**). Instructional aspects and teacher-related aspects are not in the focus of this dissertation. However, some of them (e.g., social form, subject, and teacher type) are included because of their interaction with student and/or other social aspects affecting student engagement in class.

The categories of influential aspects proposed above can also be categorized in terms of whether they belong to an internal or external type of regulatory process possibly affecting student engagement. This conclusion is supported by the findings of a recent systematic literature review of student engagement that proposes that engagement arises from "internal processes" and "external components" (Martins et al., 2022). Regulatory processes can be categorized into internal (self-)regulatory mechanisms and external, social regulatory mechanisms. "Self-regulation focuses on the cognitive and metacognitive regulatory processes used by individuals to plan, enact, and sustain their desired courses of action, whereas social regulation captures how individuals reciprocally regulate each other's cognitive and metacognitive processes and sometimes engage in genuinely shared modes of cognitive and metacognitive regulation" (Volet et al.,

2009, p. 216). In a classroom context, where several students are learning together with the help of one or more teachers, it is important that both of these types of regulation be considered in regard to student engagement and/or learning.

While aspects of the individual could be seen as relating to the internal regulation of a student in class, social and instructional aspects could be classified as relating to external social regulation of a student in class. In a classroom context internal and external regulatory processes often interact with each other and jointly contribute to student engagement during class (Volet et al., 2009). Nevertheless, most theoretical models in the context of regulation focus either on internal regulation or on external regulation. Research looking at both types of regulatory processes is rare as the theorizations behind the two types of regulation originate from different strands of research (Volet et al., 2009). Volet et al. (2009, p. 222) argue that "an integrative model, which could accommodate the unique capacity of individuals to reflect upon, feel about, and act on their experiences, as they participate in learning activities, which are also socially regulated by all the participants, would significantly advance our understanding of development and learning as it takes in real time". The present dissertation, in line with this objective, attempts to integrate aspects of internal and external regulation.

Table 1

Concepts used in prior models that included student engagement as a mediator of student learning and/or achievement.

Model	Individual Aspects	Social Aspects	Instructional Aspects	Student Engagement
Fraser, Walberg, Welch, & Hattie, 1987	Aptitude: - Ability - Development - Motivation	Environment: - Home - Classroom - Peer group - Mass media	Instruction: - Quantity - Quality	Learning achievement: - Affective - Behavioral - Cognitive
Helmke, 2009	Learning potential: - Socio-demographic characteristics - Prior knowledge - Language(s) - Intelligence - Learning and memory strategies - Learning motivation - Willingness to achieve - Persistence - Self-confidence	Class composition, Classroom climate	Instruction: - Quality of processes during instruction - Quality of teaching and learning material - Didactical context	Learning activities (Usage): - Active learning time in class - Learning activities outside school

Model	Individual Aspects	Social Aspects	Instructional Aspects	Student Engagement
Krapp, 1993	Personality of the Learner: - Motives - Values - Attitudes - Goals	Social Environment: - Social context - Group dynamics - Behavior and attitudes of the teacher	Learning situation, Object of learning: - Level of interest - Difficulty	Cognitive and emotional processes during learning: - Learning time - Learning strategies - Learning emotions
Slavin, 1994	Student inputs: - Student aptitude - Student motivation	-	Alterable variables: - Quality of instruction - Appropriate level of instruction - Incentive - Time allocated	Engaged time (time on task)
Reeve, 2012	Quality of student motivation: - Acquired sources of autonomous motivation - Inherent sources of autonomous motivation	Relationships	Learning environment: - Quality of the teacher's motivational style toward the student - External events	Student engagement: - Behavioral engagement - Emotional engagement - Cognitive engagement - Agentic engagement

Note. Terms from German models were translated by the author of the present dissertation.

2.2.2 Literature review of influences on procedural student engagement during class in elementary school

A systematic review of the literature on studies investigating factors influencing procedural student engagement during class in elementary school was conducted in early spring 2017 and updated in summer 2023. For the literature review, the databases PsycInfo, Web of Science Core Collection – Social Sciences & Humanities, and ERIC were used. The criteria were the following: (1) participants must be elementary school students approximately eight to twelve years old, (2) the measure of student engagement must be operationalizing procedural engagement, (3) student engagement must relate to engagement within class, (4) studies testing intervention batteries without a clear predictor variable were excluded, (5) empirical studies, and (6) the text must be written in English or German. The literature research initially yielded a total of 2,674 articles. After the elimination of duplicates and studies not conforming to the criteria, a final number of 42 studies remained.

The systematic review, looking specifically at empirical studies investigating influences on procedural student engagement in class in elementary school, indicates that most research mainly examined how instructional aspects affect student engagement during class (see **Table 2**). In regard to individual aspects, mainly socio-demographic aspects and academic performance were considered (see **Table 2**). Additionally, social aspects were only taken into account by a very few studies that investigated student behavior with an externally assessed measurement. The review is documented in Annexes A and B.

Table 2

Combinations of aspects affecting time on task investigated in the studies.

Individual	Instructional	Social	Studies
Academic motivation and self-control		Peer relationships	Cappella et al. (2013)
Special educational needs	Subject		Imeraj et al. (2013)
Special educational needs	Instructional setting		Baker et al. (2008); Imeraj et al. (2013)
Behavioral difficulties	Task choice		Dunlap et al. (1994)
Gender			Appel (2015); Godwin et al. (2016); Reinhold et al. (2020)
Academic performance	Task variability		Appel (2015)
Academic performance	Type of pairs		Brush (1997)
Body mass index	Physical activity		Grieco et al. (2009)
Socio-economic status	Physical activity		Mullender-Wijnsma et al. (2015)
	Physical activity		Bacon and Lord (2021); Grieco et al. (2016); Harvey et al. (2018); Szabo-Reed et al. (2017)
	Active breaks		Huddleston (2017); Raney et al. (2017)
Development	Difficulty		Alford et al. (2016)1
	Difficulty		Howie et al. (2014)
	Answering format		Haydon et al. (2010)
	Type of task		Bragg (2012)
	Instructional setting		Arlin (1979); Croll and Moses (1988); Downer et al. (2007); Godwin et al. (2016); Hollo and Hirn (2015); Muyskens and Ysseldyke (1998); Stright and Supplee (2002); Wettstein et al. (2010)

Individual	Instructional	Social	Studies
	Classes in nature		Kuo et al. (2017)
	Teacher behavior		Scott et al. (2014)
	Teacher presence/ type		Wettstein et al. (2010)
	Classroom management practices		Gage et al. (2017)
	Dialogic teaching practices		Vasalampi et al. (2021)
	Good behavior game		Hartman and Gresham (2016); (Lynne et al., 2017)
	Seating order		Bicard et al. (2012); Treptow et al. (2007)
	Duration of instruction		Appel (2015); Godwin et al. (2016)
	Gamification		Dele-Ajayi et al. (2019); Eckert et al. (2023)
	Response cards		Goodnight et al. (2019)
		Emotional climate	Brackett et al. (2011)
		Friendship groups	Farmer and Farmer (1996)
		Class size	Blatchford et al. (2011)
		Class membership	Appel (2015)
	Grade		Godwin et al. (2016)
	Time of year		Godwin et al. (2016)
	Light color		Pulay et al. (2018)
	Sugar intake		Benton and Stevens (2008)
Individual	**Instructional**	**Social**	**Studies**

Academic motivation and self-control		Peer relationships	Cappella et al. (2013)
Special educational needs	Subject		Imeraj et al. (2013)
Special educational needs	Instructional setting		Baker et al. (2008); Imeraj et al. (2013)
Behavioral difficulties	Task choice		Dunlap et al. (1994)
Gender			Appel (2015); Godwin et al. (2016); Reinhold et al. (2020)
Academic performance	Task variability		Appel (2015)
Academic performance	Type of pairs		Brush (1997)
Body mass index	Physical activity		Grieco et al. (2009)
Socio-economic status	Physical activity		Mullender-Wijnsma et al. (2015)
	Physical activity		Bacon and Lord (2021); Grieco et al. (2016); Harvey et al. (2018); Szabo-Reed et al. (2017)
	Active breaks		Huddleston (2017); Raney et al. (2017)
Development	Difficulty		Alford et al. (2016)1
	Difficulty		Howie et al. (2014)
	Answering format		Haydon et al. (2010)
	Type of task		Bragg (2012)
	Instructional setting		Arlin (1979); Croll and Moses (1988); Downer et al. (2007); Godwin et al. (2016); Hollo and Hirn (2015); Muyskens and Ysseldyke (1998); Stright and Supplee (2002); Wettstein et al. (2010)
Individual	**Instructional**	**Social**	**Studies**
	Classes in nature		Kuo et al. (2017)
	Teacher behavior		Scott et al. (2014)

Teacher presence/ type		Wettstein et al. (2010)
Classroom management practices		Gage et al. (2017)
Dialogic teaching practices		Vasalampi et al. (2021)
Good behavior game		Hartman and Gresham (2016); (Lynne et al., 2017)
Seating order		Bicard et al. (2012); Treptow et al. (2007)
Duration of instruction		Appel (2015); Godwin et al. (2016)
Gamification		Dele-Ajayi et al. (2019); Eckert et al. (2023)
Response cards		Goodnight et al. (2019)
	Emotional climate	Brackett et al. (2011)
	Friendship groups	Farmer and Farmer (1996)
	Class size	Blatchford et al. (2011)
	Class membership	Appel (2015)
Grade		Godwin et al. (2016)
Time of year		Godwin et al. (2016)
Light color		Pulay et al. (2018)
Sugar intake		Benton and Stevens (2008)

The systematic literature review indicates that the observation of student engagement in elementary school has rarely been conducted and subsequently presented in empirical research studies. Moreover, individual and social aspects affecting student engagement have been investigated even less frequently. The present dissertation seeks to tackle these research gaps in educational research specifically by combining theories from various perspectives in educational psychology.

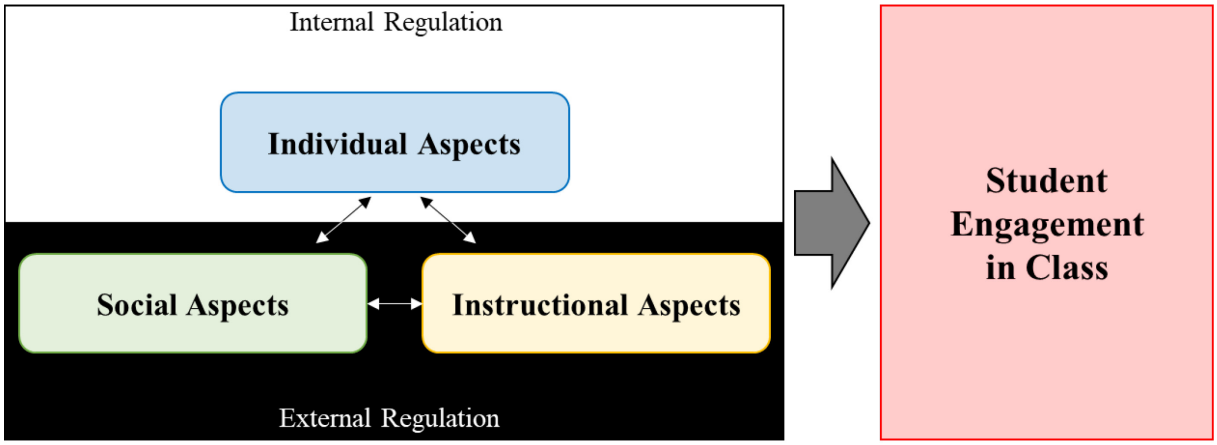
In contrast to earlier research on student engagement, which primarily investigated instructional impacts on student engagement in class and/or aspects of classroom management, the present dissertation specifically examines how individual differences and the classmates of a student might have an impact on student engagement during class. Accordingly, it lies in this as yet rarely investigated area, mentioned by Volet et al. (2009), namely how internal and external regulation might jointly influence student engagement during class.

2.2.3 General theoretical framework for this dissertation

As the synthesis of the theoretical models and the systematic literature review underlined, a model bringing together individual, social and instructional aspects is needed in order to enhance the understanding of student engagement. In light of the main research interests encapsulated by the present dissertation, however, not all variables from the models in **Table 1** will be considered. More precisely, the present dissertation will focus on variables lying on the student level. In a shorter time perspective, these might relate to student engagement during class. Additionally, some variables on the level of the class and/or lesson will be included in order to be able to control for their impact. The variables chosen for examination in this dissertation, as a result of the synthesis of previous models, a literature review on influences on student engagement in class in elementary schools, and theoretical considerations are depicted in **Figure 2** and will be discussed throughout the following two sections.

Figure 2

General theoretical framework on the interplay of internal and external regulation and their joint impact on student engagement in class.



2.3 Internal regulation and/or individual aspects

In terms of individual aspects possibly affecting student engagement in class, the present dissertation primarily investigated how motivation and/or self-control relate to student engagement during class. Empirical findings by Cappella et al. (2013, p. 367) suggest "that students with more behavioral difficulties [corresponding to difficulties in regard to self-control] or less academic motivation in the fall were less behaviorally engaged in the spring". Correspondingly, students attending the same lesson might differ regarding their engagement because of differing levels of motivation and/or self-control.

In addition to these variables, gender and SES were included as control variables in relation to individual aspects in the present dissertation because they were usually included in earlier studies of student engagement (e.g., Appel, 2015; Godwin et al., 2016), and were found to be related to students' school achievement in previous studies (e.g., meta-analysis by Voyer & Voyer, 2014).

In the next subsections, all of these variables will be discussed separately in respect to their potential impact on student engagement.

2.3.1 Self-control

Self-control is an umbrella term for processes regulating human behavior (Gawrilow et al., 2011). Self-control "refers to children's ability to manage their emotions, focus their attention, and inhibit some behaviors while activating others" (Rimm-Kaufman et al., 2009, p. 959). Accordingly, it allows for the controlling of one's own actions, thoughts, and emotions (Gawrilow et al., 2011).

The ability to control one's behavior greatly depends on the executive functions in the prefrontal cortex (Gawrilow et al., 2011). Prior research has shown a close relationship between efficient executive functions and academic performance (Hille, 2016). Nevertheless, while self-control has its roots in human brain structures relating to the executive functions, self-control still develops in interaction with the social context in which a child grows up, and, thus, can be improved by appropriate activities and a reduction of stress (e.g., Blair, 2016; Diamond, 2016). Prior work indicates that self-control is positively associated with student engagement during class (Blair & Razza, 2007; Cappella et al., 2013; Rimm-Kaufman et al., 2009; Smith-Donald et al., 2007; Zhao et al., 2019). Accordingly, it is hypothesized that self-control positively impacts student engagement during class.

Hypothesis 2a: Self-control positively predicts student engagement.

2.3.2 Motivation

While self-control has a substantial impact on whether a child is able to engage in a lesson, a child's motivation is also essential for his or her engagement during a lesson (Boekaerts, 1999). Similar to research on the conceptualization and definition of student engagement, the field of

research on motivation also "suffers from the variety and terms used for seemingly similar constructs […] readers should [thus] pay special attention to conceptual and operational definitions when interpreting results" in the area of motivation and/ or student engagement.

Generally, motivation is defined as the delineation of processes directing actions, thoughts, and emotions towards a conscious and subconscious goal and, thus, "initiating and sustaining behavior" (Anderman & Dawson, 2011; Brophy, 2004; Götz, 2011; Linnenbrink-Garcia & Patall, 2016, p. 91; Reeve, 2012; Rheinberg & Vollmeyer, 2012). As discussed in section 2.1, "Motivation is about energy and direction, the reasons for behavior, why we do what we do" (Ainley, 2012, p. 285). "It is important to note that motivation is not a 'one size fits all' term; rather motivation is complex and consists of an array of components, and these various components are more readily explained with distinct theories" (Anderman & Dawson, 2011, pp. 222-223). Linnenbrink-Garcia and Patall (2016, p. 97) state that with theory building, "came a tendency to conduct research based within a single theoretical tradition. For more than a decade, however, this trend has been changing. Researchers are now considering, both empirically and theoretically, how multiple forms of motivation from multiple theories combine to shape engagement and learning". Such an approach had already been proposed by Krapp (1993) regarding motivation and engagement, and is adopted in this dissertation.

Prior research indicates that there might be "some more stable motivational tendencies" (trait motivation), "which can be theoretically differentiated from the current motivation for a specific act" (state motivation; Götz, 2011, p. 82). Accordingly, similar to student engagement (see discussion in section 2.1.3), motivation might also be conceptualized on the continuum of states and traits. This is, according to Wigfield and Koenka (2020), in line with most current theories on motivation.

Motivation might originate from different sources. Lewin (1935) proposed a 'person-in-context view', postulating that "motivation emerges from the interaction between individuals within the social context of the classroom and school" (Urdan & Schoenfelder, 2006, p. 333). Generally in motivational psychology, motivation is divided into 'intrinsic motivation' and 'extrinsic motivation' (e.g., self-determination theory: Ryan & Deci, 2000). In the present dissertation, intrinsic motivation refers to motivation originating from sources within a person (e.g., enjoyment, interest), while extrinsic motivation refers to motivation originating from sources outside a person (e.g., rewards, punishments from teachers, parents and/or classmates). It is assumed that the motivation to engage during class might be simultaneously affected by multiple different sources inside or outside a student. This proposition is in line with the perspective of students pursuing multiple, parallel goals that might be more or less concordant with one another (Boekaerts, 2002). Accordingly, it is assumed that students could at the same time possess external motivation to engage in class, originating from their parents' expectations of their behavior at school, and at the same time students could also possess intrinsic motivation because they are interested in the subject.

In the following sections, intrinsic and extrinsic sources of motivation are further discussed.

2.3.2.1 Intrinsic origins of motivation

Intrinsic motivation refers to sources of motivation within a person (e.g., enjoyment, interest). Accordingly, the "action itself is accompanied by positive states of experience" (Schiefele & Schaffner, 2015, p. 155, author's translation). Intrinsic motivation in class could thus be experienced by students as interest, joy, or fun during class. Accordingly, interest is part of the definition of intrinsic motivation. According to Reeve (1989, p. 83), "Interest contributes to intrinsic motivation by arousing the initiation and direction of attention and exploratory behavior,

while enjoyment contributes to intrinsic motivation by sustaining the willingness to continue and persist in the activity».

Previous research indicates that intrinsic motivation improves student engagement during class: Young students' interest positively impacts their persistence in a learning task (Ainley et al., 2005; Ainley, Hidi, et al., 2002; Ainley, Hillman, et al., 2002). Similarly, previous research with young students indicates that intrinsic motivation positively improves student engagement during class (Cappella et al., 2013; Zhao et al., 2019). It is thus hypothesized that intrinsic motivation positively predicts student engagement in class.

Hypothesis 2b: Intrinsic motivation positively predicts student engagement in class.

Nevertheless, multiple studies indicate that, in a longitudinal view, this relationship might not be as unidirectional as commonly expected (Laine et al., 2020; Steinhoff & Buchmann, 2017). Instead, these studies propose a co-development between interest and engagement. On one hand, "interest predicts learning outcomes: people acquire new knowledge about a topic they find interesting" (Laine et al., 2020, p. 90). On the other hand, in the long term, "academic interest triggers a feedback loop with effortful engagement gradually leading towards differential educational attainment" (Steinhoff & Buchmann, 2017, p. 122). Accordingly, while at first, intrinsic motivation might ignite student engagement in class, in the longer term student engagement during class might reinforce student motivation, and, therefore amplify student engagement even more. According to Wigfield and Koenka (2020, p. 2), this view is in line with current models of motivational processes, which assume a "bidirectional, cumulative, and dynamic nature of relations among the constructs in their models both over time and across situations", although this aspect might not always be very well represented in the static, two-dimensional model presentations. This dissertation, however, is mainly looking at the impact of

motivation on student engagement, as it is only taking a short-term cross-sectional perspective into account.

2.3.2.2 Extrinsic origins of motivation

Extrinsic motivation refers to sources of motivation outside a person (e.g., rewards, punishments from teachers, parents and/or classmates). Accordingly, an action "causes positive consequences or prevents negative consequences" (Schiefele & Schaffner, 2015, p. 155, author's translation). Regarding student engagement, most of these consequences of actions are caused by other people (e.g., teachers and/or classmates). Accordingly, extrinsic motivation in this understanding actually relates strongly to external regulation, and, therefore will be discussed in more detail in terms of social aspects possibly relevant to student engagement in class (see section 2.4.1).

2.3.3 Interrelationships between motivation and self-control

Previous research proposes that high motivation alone might not be sufficient for high engagement of students during class. As Appleton et al. (2006, p. 428) write, "one can be motivated but not actively engage in a task. Motivation is thus necessary, but not sufficient for engagement". Consequently, it is not really clear whether either motivation or self-control is sufficient for students to engage in class, or, whether both are needed at the same time to achieve a high level of engagement during class. In line with the proposition of Appleton et al. (2006), this dissertation's proposition is that the effect of (intrinsic and/or extrinsic) motivation on student engagement during class is moderated by self-control. It is assumed that the higher a student's self-control is, the stronger the impact of motivation on student engagement should be.

Hypothesis 2c: Self-control moderates the relationship between (intrinsic and/or extrinsic) motivation and engagement. The higher the self-control, the stronger the relationship between motivation and student engagement.

2.3.4 Gender

Several studies have investigated student engagement in regard to gender and find that girls generally are slightly more engaged in class than boys (e.g., Appel, 2015; Godwin et al., 2016; Marks, 2000) Accordingly, it is assumed that female students show higher engagement during class than male students.

Hypothesis 3a: Student engagement during class is higher for female than for male students.

Nevertheless, most of these studies lack a discussion of why this effect appears. A possible theoretical explanation for this effect might be that the expected behavior (social norm) for female versus male students differs in a school context. This proposition is supported by recent studies investigating gender expectations throughout childhood (e.g., Brown & Alexandersen, 2020; Coelho et al., 2021). Concerning this theoretical assumption, gender actually would need to be included in the discussion of external regulation, as it is the expectations of other people that affects student engagement. Accordingly, it again becomes apparent that internal and external regulatory processes are entangled in terms of student engagement in class.

2.3.5 Socio-economic status

Multiple studies find that a higher socio-economic status is associated with higher engagement in class (e.g., Appel, 2015; Godwin et al., 2016). Accordingly, it is assumed that the socio-economic status of students positively relates to student engagement during class.

Hypothesis 3b: Socio-economic status positively relates to student engagement.

Similar to the studies investigating gender, these studies usually lack a discussion of why this effect appears. A recent Chinese study of high school students indicates that the effect of socio-economic status might occur because families with a higher socio-economic status have more resources available to invest in their children, thus leading to an improved environment for the development of their children, than do families with a lower socio-economic status (Chen et al., 2021).

2.4 External regulation

In section 2.3.2 on motivation it became evident that student engagement during class might be affected by not only individual (internal) differences , but also (external) factors deriving from a student's environment in the classroom, namely social and instructional aspects. Contrary to most of the traditional models of student achievement, which posit a subsidiary role for social relationships in regard to student engagement, some theories and models attribute a more important role to social relationships (e.g., Mascareño Lara et al., 2023; Reeve, 2012; Sinatra et al., 2015; Volet et al., 2009). Furrer et al. (2014, p. 101) even state that "the quality of students' relationships with teachers and peers is a fundamental substrate for the development of academic engagement and achievement".

2.4.1 Social aspects

Sinatra et al. (2015, p. 8) propose that in regard to social aspects, "engagement measurement can theoretically be conceptualized on a continuum from person oriented to context oriented". In the most popular person-oriented conceptualization, "researchers focus their investigations on the individual's engagement with a topic or task" (Sinatra et al., 2015, p. 8), while in the context-oriented conceptualization, "researchers focus on capturing the characteristics of the classroom, school, community, or culture that afford or impede engagement" (Sinatra et al.,

2015, p. 9). Between the two poles of the continuum lies a person-in-context conceptualization of engagement. This is where the present dissertation can be situated. “Researchers coming from this theoretical framework strive to understand the individual embedded within a particular context, thus the focus is on describing the interaction itself” (Sinatra et al., 2015, p. 9). The results of a recent systematic Dutch review of student engagement as a collective process are congruent with these findings. The review stated that “the results showed that the traditional, individual definition of engagement is dominant. A number of studies looked at engagement a) at the collective level b) as a dialectical individual and collective process, or c) as an aggregate of individuals” (Mascareño Lara et al., 2023, English abstract).

These latter authors assume that internal and external regulation might be important predictors of student engagement in class (Volet et al., 2009). Such “an integrated perspective of regulation makes it possible to conceptualize the social context from a process-oriented approach in which the social represents an (inter)active element that contributes to affording or constraining members’ participation” in class (Volet et al., 2009, p. 223).

Several studies indicate that classmates might have an important impact on student engagement during class in elementary school (e.g., Appel, 2015; Figlio, 2007; Wettstein et al., 2010). Nevertheless, this was often a secondary finding of the studies, which was not investigated more thoroughly. “In general, researchers have focused more on teachers and parents than peers as socializing agents of motivation and engagement” (Ryan, 2000, p. 101). Accordingly, a primary focus on classmates and relationships in the classroom also allows this research gap of how classmates influence student engagement during class to be addressed (e.g., Eccles et al., 1998; Kindermann et al., 1996; Rubin & Hebert, 1998; Urdan & Schoenfelder, 2006; Urdan & Turner, 2005). Accordingly, in regard to the social context, this dissertation is investigating influences from classmates as well as influences from teachers. Note that, as the focus of this dissertation

lies on the student level, there will be a stronger focus on classmate-related than on teacher-related aspects.

2.4.1.1 Social norms in the classroom

Several studies indicate that the classroom might have an important association with student engagement during class. The findings suggest that a positive class climate might promote student engagement (Eder, 1996), and that student engagement is higher in smaller classes than in larger ones (Blatchford et al., 2011). Further, an important effect of class membership on student engagement was found (Appel, 2015), indicating that classmates and the teacher might have an impact on a student's engagement during class.

Multiple studies show that the other classmates' behaviors have an impact on the behavior of students in the classroom (e.g., Barth et al., 2004; Kellam et al., 1998; Kuppens et al., 2008; Mercer et al., 2009; Müller & Zurbriggen, 2016). It is postulated that this influence happens because social norms are active in the classroom (e.g., Dishion & Tipsord, 2011; Hartup, 2009; Müller & Zurbriggen, 2016). It is assumed that the same applies to student engagement in class. Social norms describe what behavior is explicitly and/or implicitly expected in a certain situation by a certain person belonging to a certain society. Accordingly, 'acceptable' behavior might differ depending on the individual characteristics of a person, the situation, and/or the society to which the person belongs (Cialdini et al., 1990; Cislaghi & Heise, 2020; Deutsch & Gerard, 1955). For example, there are different expectations of girls and boys concerning their clothing in class (e.g., only girls are expected to wear a skirt in Switzerland). Furthermore, these clothing expectations differ depending on the occasion (e.g., students are expected to dress differently for sports lessons in the gym than for other lessons in the classroom). Additionally, these expectations differ depending on the society a student lives in (e.g., in Switzerland in most

public schools children do not wear school uniforms. However in other countries, such as Japan, students in most schools are required to wear their school's uniform).

Social norms can act as a source of external motivation, as acting according to social norms is usually associated with positive reactions from people in a student's social context (e.g., praise, a compliment, positive commentary/feedback, gaining popularity in the classroom, getting special attention and/or favors), while acting against social norms is accompanied by negative reactions (e.g., blame, negative commentary/feedback, a punishment, social exclusion, being bullied). Accordingly, students are socially motivated to engage in appropriate behavior, according to the social norms in play, in order to avoid receiving such negative reactions (Gruter & Masters, 1986; Rudman & Fairchild, 2004; Wesselmann et al., 2014).

Social norms can further be differentiated depending on whether they are explicitly or implicitly communicated. On one hand, explicitly communicated social norms such as classroom/school rules and/or explicitly stated expectations are usually called 'injunctive' social norms. This type of social norm might mainly be of interest in section 2.4.1.3, when the impact of the teacher on student engagement is discussed. On the other hand, implicit behavioral expectations, not verbalized but observable, are usually called 'descriptive' social norms (Gruter & Masters, 1986; Rudman & Fairchild, 2004; Wesselmann et al., 2014). An example of a descriptive social norm in the classroom is the acceptable volume of talking in a classroom during group work. The volume might differ significantly among classrooms during group work, depending on the class and the preference of the teacher. A new student joining the class might automatically adapt to the volume experienced. While this example relies not only on the classmates' impact, but also on the teacher's impact on a student's behavior, the impact of the class on the volume experienced might not be negligible, as the teacher might adapt his/her impression of an acceptable

volume depending on the ease of managing the specific classroom. This second type of descriptive social norm might especially be important when investigating classmates' influences on a student's engagement during class.

In the following, first, the classmates' effect and then the teachers' effect on student engagement during class are further discussed.

2.4.1.2 Classmates

Classmates are all the other students in a classroom. Sometimes classmates are also referred to as 'peers'. However, the term peers is not consistently used in social research as it sometimes refers to all other students in the same age group (Ryan, 2000). A classroom, and the classmates of a student, describe an 'institutionally assigned' group (Kindermann, 2016, p. 33). In contrast, students might build friendships and/or friendship groups in a classroom. These could be described as 'self-selected'(Kindermann, 2016, p. 33). Accordingly, classmates can be regarded as having a different type of relationship from that of "personal friends, with whom students share social bonds and similarity in behaviors and attitudes" (Müller & Zurbriggen, 2016, p. 7). Accordingly, the influence of friendships in class, and classmates in general, on student behavior might differ (Powers & Bierman, 2013).

2.4.1.2.1 Classmates' social norms

The transmission of social norms between classmates might depend on various mechanisms, such as (non-)verbal positive/negative reinforcement (Dishion & Tipsord, 2011), social comparison (Festinger, 1954), and/or social modeling (Bandura, 1977). Regarding descriptive social norms in the area of aggression, prior experimental research shows that these processes relating to social norms affect the aggression enacted between students (Müller & Zurbriggen, 2016).

Research shows that generally "it does not seem to be the case that peer influences necessarily occur at the expense of learning. Instead, they may foster learning" (Kindermann, 2016, p. 31), as "peers not only exert influence on externalizing but also on internalizing and social competent behaviors of children" (Müller & Zurbriggen, 2016, p. 5). Therefore, it is hypothesized that subjectively perceived descriptive norms of student engagement in class positively affect student engagement.

Hypothesis 4a: Subjectively perceived descriptive class-engagement norms positively predict student engagement.

In the light of the theorizations on descriptive social norms, the question of whether there might be a social referent effect on student engagement in class can be posed. The social referent effect was described by Festinger (1954). It postulates that people evaluate themselves and their own behavior through interaction with their social context. If there is no objective indicator of people's own performance, they thus compare themselves to other people in their environment who that are judged as significant for comparison. Usually, this means that people compare themselves with people similar to themselves. For student engagement during class, this would mean that students compare themselves within the classroom with classmates to find out whether they are showing 'normal' engagement. While students could compare themselves to any other classmate, they probably will not compare themselves to either the most diligent or the least diligent classmate, but will be more likely to compare themselves to a similar student in class. This proposition is in line with the shifting standards model (Biernat & Manis, 1994). This model proposes that judgments about a behavior exhibited are impacted by the comparison of people in regard to their salient groups of reference. For example, the same magnitude of student engagement in class might be perceived differently depending on whether the student is part of a very strong, highly engaged classroom, or whether the student is part of a weaker,

less engaged classroom. The effect of shifting standards was corroborated by multiple studies (e.g., Biernat et al., 2009; Biernat & Fuegen, 2001; Biernat & Kobrynowicz, 1997; Biernat & Manis, 1994; Biernat et al., 1991; Biernat et al., 1998; Bridges et al., 2002; Fuegen et al., 2004) and is similar to the well-known 'big-fish-little-pond effect' in educational sciences regarding student performance (Marsh & Parker, 1984). The 'big-fish-little-pond effect' states that "equally able students have lower academic self-concepts in schools or classes where the average achievement level is high than in schools or classes where the average achievement level is low" (Dijkstra et al., 2008, p. 587). Accordingly, it is hypothesized that a similar context effect also exists in regard to student engagement in class.

Hypothesis 4b: There is a comparison referent effect related to class membership in regard to student engagement. Students with similar state on-task engagement rate their self-reported engagement higher or lower than the class's average student engagement, in line with their perceptions of the class's engagement.

2.4.1.2.2 Social structure within a classroom

Through daily interactions in class, students build an informal social structure within their classroom (Neuenschwander, 2005; Youniss, 1982). Studies show that there is a relationship between a student's social position within a class and her or his social behavior within a classroom (Berg et al., 2015; Estell et al., 2008; Farmer & Farmer, 1996). Nonetheless, there is only a small amount of evidence available and it is not fully consistent. Generally, studies show that peer acceptance promotes motivation, engagement, and learning in class (Cappella et al., 2013; Cillessen & van den Berg, 2012; Juvonen et al., 2012; Ladd & Dinella, 2009), while students experiencing social rejection in the classroom generally are less likely to be engaged and more likely to show aggressive and/or off-task behavior during class (Buhs et al., 2006).

Hypothesis 4c: Students with high engagement are more likely to be accepted by classmates.

Hypothesis 4d: Students with low engagement are more likely to be rejected by classmates.

2.4.1.2.3 Friendships within a classroom

Daily interactions contribute not only to the construction of an informal social structure, but also to the formation of friendships within a classroom. It is theorized that personal goals and motivations build the foundations of such an informal friendship formation (Robins, 2015; Youniss, 1982). Studies show that students who are friends are similar in their personalities, levels of motivation, and social behavior in class (Altermatt & Pomerantz, 2003; Farmer & Farmer, 1996; Farmer et al., 1999; Hogue & Steinberg, 1995; Kindermann, 1993; Rubin et al., 1994). Accordingly, not only a classroom's social norms but also, or even more strongly, the norms within a friendship group might have an impact on a student's motivation during class. Consequently, it is assumed that friendships are more likely to build between students displaying a similar level of intrinsic motivation.

Hypothesis 4g: Students with a similar level of intrinsic motivation are more likely to be friends.

Hypothesis 4h: Students with a different level of intrinsic motivation are more likely to be rejected.

2.4.1.3 Teacher

Not only classmates, but also teachers can be a source of extrinsic motivation for student engagement in class. Teacher-student relationships "were shown to have an important but not exclusive role in their association with a comprehensive range of indicators of student engagement" (Quin, 2017, p. 345). As discussed earlier, teachers might reinforce extrinsic motivation through social norms. Teachers might, for example, reinforce extrinsic motivation by rewarding positive actions and/or punishing negative actions by students. Such rewards and/or punishments are often explicitly announced, for example by distributing 'stars' for 'good behavior'

and/or withdrawing stars for ‘bad behavior’, and therefore usually are described as injunctive social norms.

Such behavioral interventions are usually based on behavioral theorizations with their foundations in the paradigm of operant conditioning, proposing that reinforcement and/or punishment can motivate behavior (Skinner, 1965). Accordingly, it is assumed that extrinsic motivation relating to teachers positively predicts student engagement during class.

Hypothesis 5a: Teacher and/or parent-related extrinsic motivation positively predict student engagement.

Although such reward-punishment operant conditioning systems in class are widespread in schools, there is a big debate on “the benefits versus potential problems associated with the use of extrinsic rewards” (Anderman & Dawson, 2011, p. 227). Several problems are discussed.

For example, the paradigm of operant conditioning comes with an underlying perspective on students as passive agents. Additionally, there are classical social psychological studies indicating that extrinsic reinforcement of a behavior might diminish a child’s intrinsic motivation to act upon the behavior. Accordingly, if the extrinsic reinforcement of the behavior ceases to exist, the child will no longer show the behavior (overjustification effect; Bem, 1972; Greene et al., 1976).

As discussed earlier, the teacher might also have an impact on descriptive social norms in the classroom. While, as we have seen, there is an important contribution by a class to the descriptive norms in a classroom, these descriptive social norms are also affected by the teacher’s preferences regarding, for example, the volume of speaking or the tidiness of a classroom. In contrast to the balance between students in class, however, the power balance between the teacher and the students is not symmetrical. Accordingly, the teacher might already from the

beginning declare his/her behavioral expectations regarding the volume of speaking and/or tidiness of the classroom, and, thus be implementing explicit, injunctive social norms about these behaviors (Cialdini et al., 1990; Cislaghi & Heise, 2020; Deutsch & Gerard, 1955).

While most studies on social norms did not originate from an elementary school context, there are some studies supporting the proposition that social norms work in classrooms. A study by Scott et al. (2014) found that students were more likely to be engaged in class (and less likely to cause disruptions in class), the more teachers were focused on their students during class. Accordingly, when students do not perceive the presence of their teacher, they might not feel the need to conform to the social norms proposed by a teacher. Additionally, other studies indicate that in elementary school, student engagement might differ depending on how often a teacher works with a class (Wettstein, 2008; Wettstein et al., 2010). Students in the study were less likely to show disruptive and/or aggressive behaviors during lessons with their main class teachers than with teachers they experience only in single subjects and/or substitute teachers. Moreover, they found that students were more likely to show disruptive and/or aggressive behaviors when teachers were not present in the classroom, supporting the finding of Scott et al. (2014).

Hypothesis 5b: Student engagement during class is higher for main class teachers than for subject teachers.

2.4.2 Instructional aspects

The current learning situation in class might affect student engagement in regard to intrinsic and extrinsic motivation. On one hand, concerning mainly intrinsic motivation, the current subject and/or the current topic of a lesson might be more or less interesting to a student and, therefore, lead to a different level of engagement by the student in class. On the other hand,

depending on the social form, social behavioral norms might be more salient in class. In the following two sub-sections, research regarding these two factors is presented.

2.4.2.1 Subject

While there are no studies comparing student engagement behavior in different subjects in elementary schools, there is some previous research investigating student motivation depending on school subjects.

Previous research finds that, generally, students have similar levels of enjoyment for lessons in the subjects of mathematics, physics, German, and English. Nevertheless, girls usually slightly prefer languages, while boys usually prefer science-oriented subjects (Gaspard et al., 2016; Götz et al., 2014). This gender-related difference, however, might not be related to the subjects themselves, but to the social perceptions of the different types of subjects, as previous studies show a socially influenced perceived negative association between the female gender and science-oriented subjects such as mathematics and physics (Makarova & Herzog, 2015). When French was also considered, students generally report lower motivation in French than in other subjects (Brühwiler & Racine, 2017; Gaspard et al., 2016). Other subjects (such as arts and crafts and/or physical education) are not usually taken into consideration in such comparative studies. Accordingly, as student engagement relates to student motivation, it is expected to vary between subjects.

Hypothesis 6a: Student engagement differs depending on the subject.

2.4.2.2 Social form

Previous research indicates that not only the subject, but also the social form of a lesson might influence student engagement in class.

Student engagement can be facilitated by learning in a fun (and, thus, engaging) way. Accordingly, when the social form fosters student intrinsic motivation, student engagement is increased. For example, student engagement in math classes is higher during games than during other forms of teaching (Bragg, 2012). Additionally, changes in the type of social form, including physical activity breaks, in the classroom might also attenuate boredom and/or tiredness, and promote student engagement (Grieco et al., 2016). Student engagement might benefit from adapting the difficulty of the tasks to the children in a classroom (Alford et al., 2016; Treptow et al., 2007).

Several studies found that student engagement differs depending on the social form (Baker et al., 2008; Downer et al., 2007; Godwin et al., 2016; Stright & Supplee, 2002). While the findings are inconclusive, there is a certain pattern visible. Usually, group and/or partner work and teaching-learner conversations were associated with higher student engagement than individual work and/or frontal teaching.

Hypothesis 6b: Student engagement differs depending on the social form.

Previous research further shows that the engagement of lower achieving students and/or students with weaker self-control is more sensitive to variations in the social form than the engagement of higher achieving students in class. Accordingly, the engagement of weaker students varies more widely among different types of instructional settings (Appel, 2015; Baker et al., 2008; Blatchford et al., 2011; Darmody & Thornton, 2015; Good & Beckerman, 1978; Helmke et al., 1986; Yair, 2000).

2.5 Theoretical model and overview of hypotheses

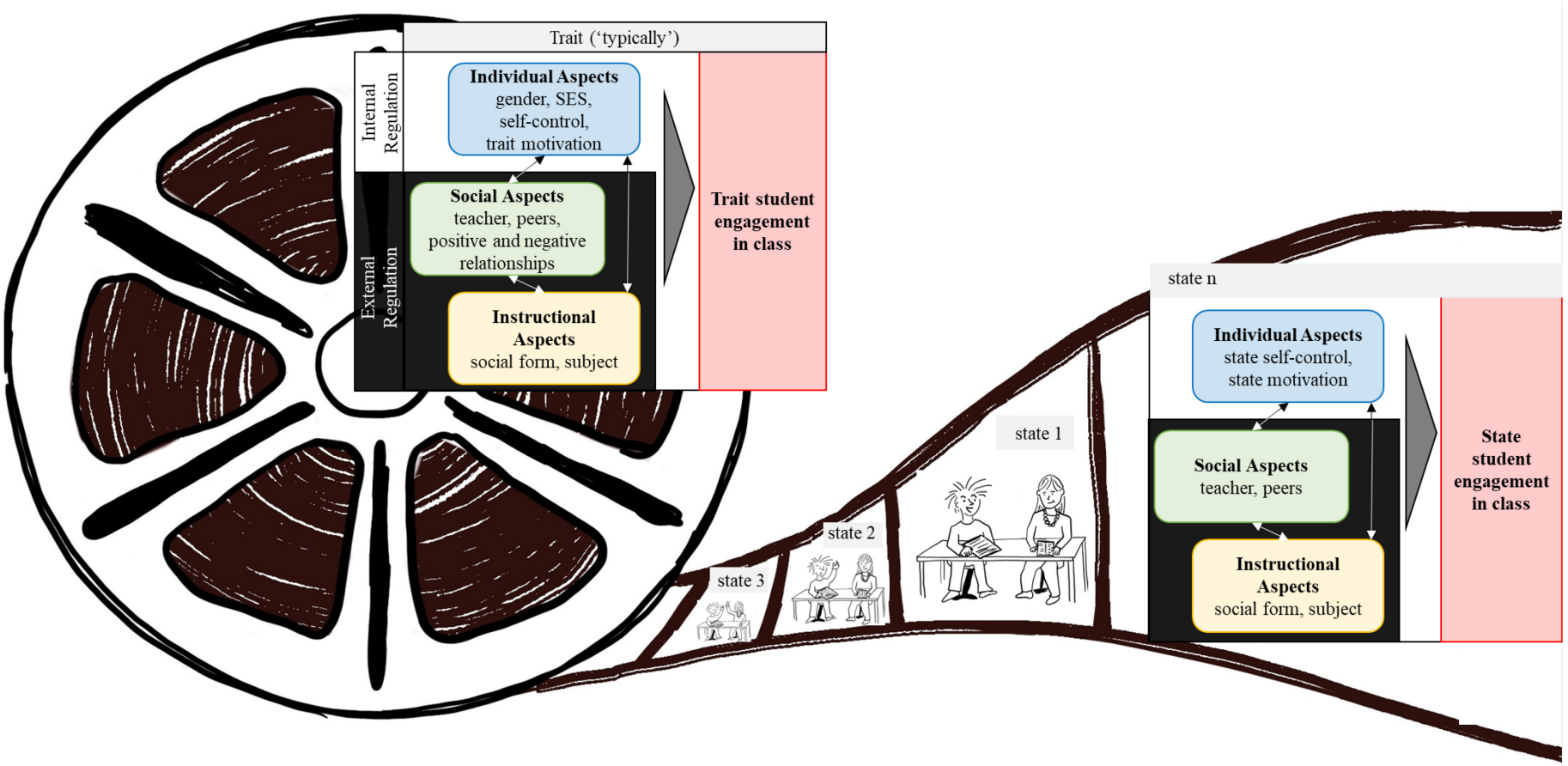
The theoretical model of the present dissertation synthesizes and visualizes the hypotheses derived from the theoretical background. As a model it does not intend to represent a perfect image of reality or to include all possible influences on student engagement in class. However,

it is intended to display the theoretical background and understanding relevant for the present dissertation. The theoretical model is displayed in **Figure 3**.

In the working model, in congruence with the general theoretical framework of the dissertation proposed earlier (see section 2.2.3), aspects influencing student engagement in class are categorized into individual, social, and instructional aspects. Additional to this categorization and the association with internal and external regulation, the dimension of stability, differentiating between traits and states, was added in this model. While trait components relate to how an aspect such as student engagement is displayed in general, over a long period of time, state components relate to the display of an aspect in a specific situation. Accordingly, theoretically, all state components accumulated together should result in the trait component (Geiser et al., 2017). Further, in comparison to the general framework visualized in **Figure 2**, the working model includes and summarizes the possible influences on student engagement described in the previous sections.

Figure 3

Working model on the interplay of internal and external regulation and their joint impact on student engagement in class.



Note. The drawings of the movie roll as well as the students sitting at a table in class were drawn in the iPad app "Procreate" by the author of this dissertation. The drawings were inspired by the logo used in the research project "Klassenteams", in which this dissertation is situated (see www.klassenteams.ch)

3 Methodology

In the current section, first, the context and procedure of the data collection are presented. Second, the recruitment process and the final sample for this dissertation are described. Third, the instruments used for data collection are outlined. Finally, an overview of the data analysis is presented.

3.1 Context of the data collection

The data collection for this dissertation was embedded within the associated larger research project 'Klassenteams' (www.klassenteams.ch). This is a joint project of the School of Education of the University of Applied Sciences and Arts Northwestern Switzerland and the St. Gallen University of Teacher Education. The Swiss National Science Foundation funded the research. The main goal of the overall project 'Klassenteams' is to investigate how teacher cooperation relates to classroom management and how classroom management is associated with student on-task activity. This dissertation is located at the student level of the project 'Klassenteams'. The instruments used to collect the student level data were composed for use in the present dissertation, while integrating measures necessary for the overall project 'Klassenteams'. Consequently, mainly student level data of the project is presented and discussed throughout the present dissertation. In addition to the student level data, information on social forms of the lesson is also used for the present dissertation. This observational measure, however, was not compiled by the author of the current dissertation.

The following sections outline the methods used to collect the present study's data. They cover sampling, the procedure, and the research instruments.

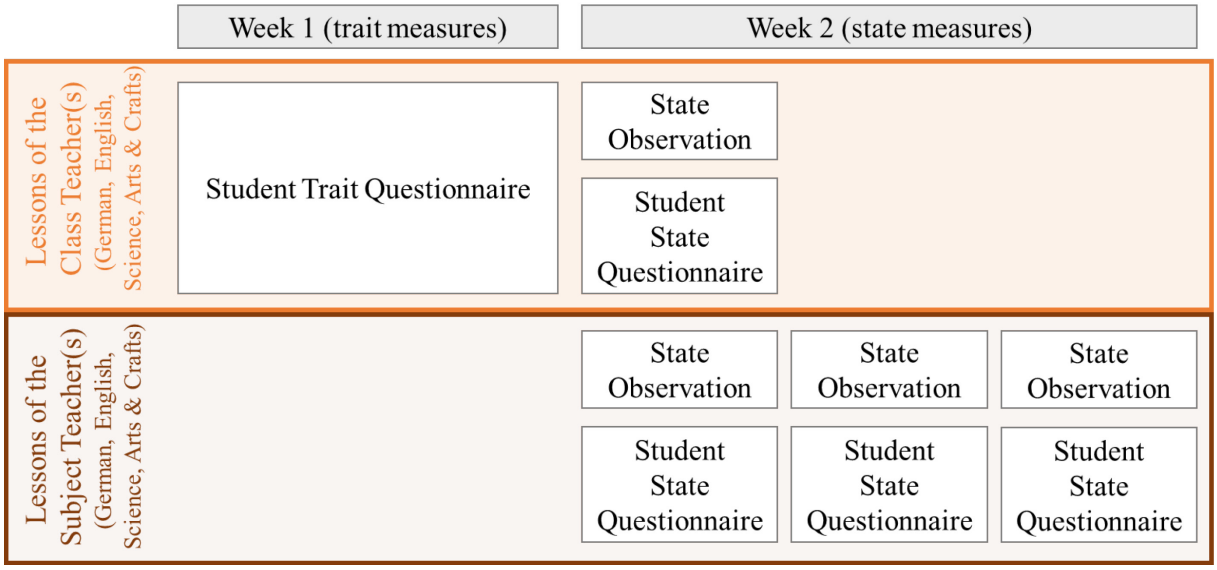
3.2 Procedure

Data collection lasted two weeks per class for the purpose of collecting trait and state measures of the different concepts under investigation. Accordingly, extensive planning of the data collection was necessary to accommodate the schedule of each class. As a first step, main class teachers were asked to provide information about the class team (all teachers instructing in their class), the class schedule, the languages spoken by the students' parents, and the preferred timeframe for the two weeks of the study. With this information, we were able to plan data collection and to send the main class teachers the student consent forms in the languages spoken by the students' parents. The main class teachers distributed and collected the consent forms from the students and handed them back to the research team. Teachers, of course, also received a consent form.

The study procedure is depicted in **Figure 4**. In the first week, stable constructs were assessed through the student trait questionnaire. Throughout the second week, the same constructs were assessed situationally, observing student engagement in up to four subjects (Arts and Crafts, English, German, and/or Social and Natural Sciences) taught by different teachers (main class teacher and subject teachers). For each of these lessons, the students answered a student state questionnaire. As far as possible, all the observations with the different teachers were conducted on the same day. However, it was often necessary to revisit the classes two to three times to conduct all observations.

Figure 4

Study procedure.



The gap of a week between the trait and the state measures was intended to avoid students 'copying' their answers from the general student questionnaire into the student post-lesson questionnaire, as both measures contained similar questions in regard to motivation and engagement during class.

The four subjects (Arts and Crafts, English, German, and Social and Natural Sciences) were chosen for the overall project 'Klassenteams' in the light of two main criteria. First, as the overall project 'Klassenteams' intended to observe one lesson by each teacher in the class team, subjects were chosen according to the types of teachers usually instructing these subjects. A pre-study of the overall project 'Klassenteams' (Vogt et al., 2022) conducted in the cantons of Aargau and St. Gallen in Switzerland indicated that 97% of the class teams included a subject teacher in Arts and Crafts, and 66% of the class teams included a subject teacher in English. Subject teachers in French were present in only 16% of the class teams, while the other subjects taught by professional teachers (German, Mathematics, Social and Natural Sciences, etc.) in the pre-study samples were usually taught by the main class teachers and/or their job-sharing partners. The second criteria for the choice of subjects concerned the motivation found in these

subjects during earlier studies. Previous studies measuring student trait motivation found significant differences in relation to different school subjects (as discussed in section 2.4.2.1). The aim was to choose subjects towards which students would possess a similar level of trait motivation. Accordingly, French, for example, was not considered for this study, as generally, low student motivation was found in French compared with motivation levels in other subjects in previous studies (Brühwiler & Racine, 2017; Gaspard et al., 2016; Götz et al., 2014). Moreover, in regard to subjects taught by main class teachers, German and Social and Natural Sciences were chosen, as students in previous studies reported a similar level of trait motivation concerning these two subjects, while girls usually scored slightly higher in language subjects and boys usually scored higher in science-oriented subjects (Gaspard et al., 2016; Götz et al., 2014).

In the present research project, observing multiple lessons per teacher was avoided to minimize the burden of study participation on teachers and students. Accordingly, not all four subjects were observed in all 34 classes. In consequence, the sample size varies when separating the data into the different subjects and/or by teacher types, depending on the number of subject and/or main class teachers in a class team. The interconnection of teacher type and subject is depicted in **Table 3** below. The implication of this interconnection for the analyses made in the present dissertation is discussed below in the section relating to data analysis.

Table 3

Interconnection of teacher types and subjects: Number of teachers by type (main class teacher versus subject teacher) in each of the observed subjects.

	Subject			
Teacher type	Arts and Crafts	English	German	Social and Natural Sciences
Main class teacher	1	9	11	19
Subject teacher	31	14	6	1

After participating in the study, all classes received 50 Swiss Francs for their class fund. Moreover, we offered school principals a free customized workshop on active learning time for their teachers. Additionally, all participating teachers separately received a personal thank you card for their participation.

To connect the multiple measurements of the individual participants, it was necessary to use participant names during the data collection. To pseudonymize the data in accordance with ethical guidelines, all names were altered into student and teacher codes during data preparation. These codes are each composed of nine digits according to a coding key defined by the investigators. For the data analysis, the only purpose of these codes was to identify which measurements belonged to which student or teacher. In accordance with the consent forms for the participants and the Swiss data protection law (Article 13, paragraph 2 e.), the results of the analyses of the present study do not allow for the re-identification of individual participants.

3.3 Recruitment process and sample description

The classes in the present sample were drawn from the population of classes in German-speaking municipalities with a low or high percentage of foreign nationals in Swiss cantons where students learn English as a first foreign language (for further details see the section 3.3.1 below). As the sample of 34 participating classes is very small in comparison to the number of schools available in all 755 municipalities, our sample most likely is not representative of the whole population of German-speaking municipalities of Switzerland, although the sample was drawn by random stratified sampling (as described in further detail in section 3.3.1). The small sample size limits the generalizability of the findings. Nevertheless, this sampling approach allows for the avoidance of sampling error and approaches representativeness (Zimmermann et al., 2004).

3.3.1 Recruitment process

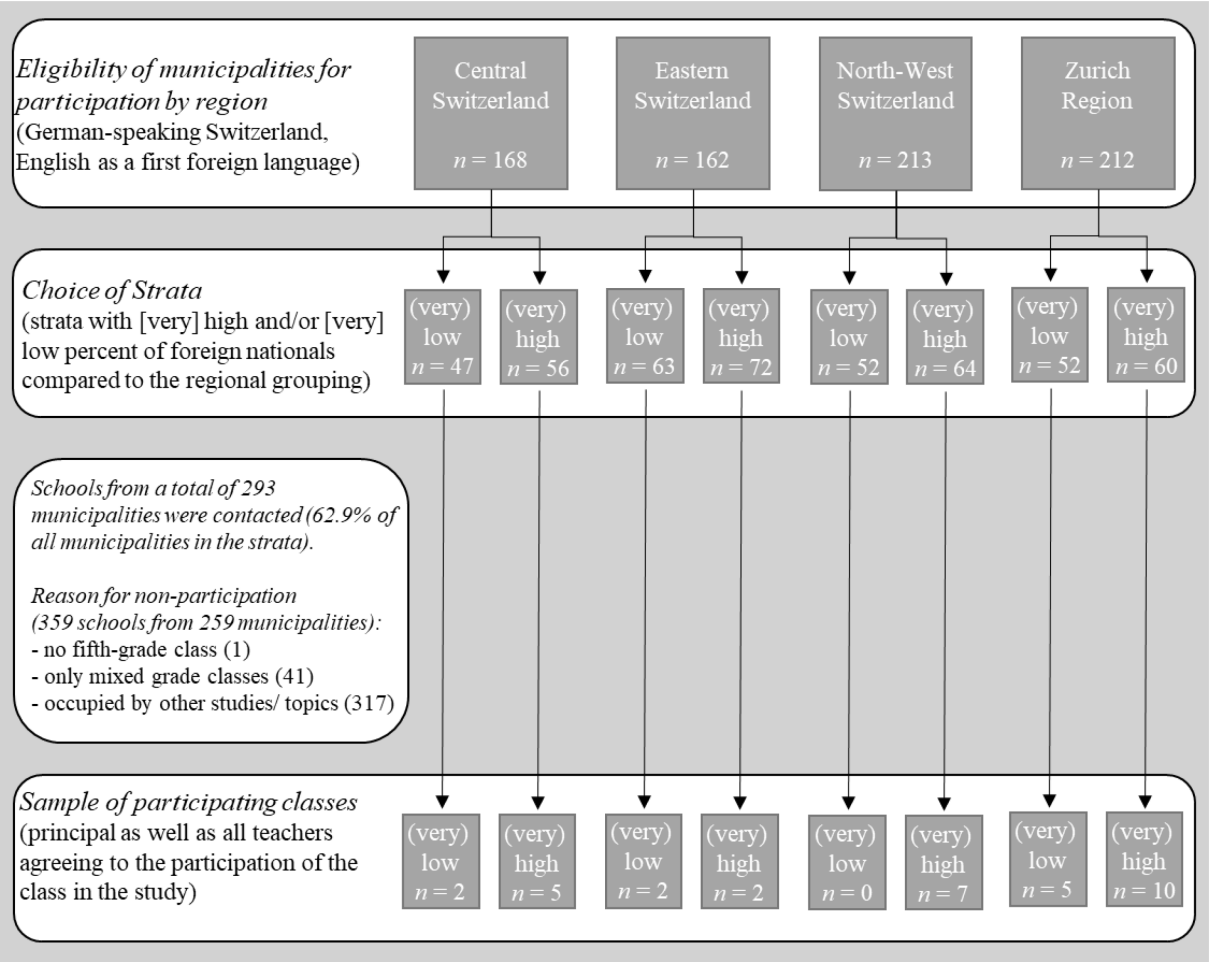
Recruitment was by random stratified sampling (adapted from the approach used by Zimmermann et al., 2004). A stratified approach was chosen in order to obtain a higher diversity of migration status in the sample. Migration status is linked to lower academic achievement (e.g., Nielsen & Rangvid, 2012; Rodriguez-Fernandez et al., 2020; White, 1982), which is linked to lower engagement in class (e.g., Finn et al., 1995; Hattie & Anderman, 2013; Klem & Connell, 2004; Wasson et al., 1990). The percentage of foreign nationals by community was therefore used as an indicator for building the strata.

The recruitment process is illustrated in **Figure 5** and documented in the technical report of the research project 'Klassenteams'(Kunz Heim et al., nd). First, all German-speaking Swiss municipalities in the cantons where students learn English (and not French or Romansh) as a first foreign language were chosen (EDK/IDES, 2016). This choice was necessary because German and English were chosen for the 'Klassenteams' study. The municipalities in these fourteen cantons were then allocated into their major regional groupings (Martin et al., 1999): Central Switzerland (Lucerne, Zug, Schwyz, Obwalden, Nidwalden, Uri), Eastern Switzerland (Appenzell Ausserrhoden, Appenzell Innerrhoden, Glarus, Schaffhausen, St. Gallen, Thurgau), North-West Switzerland (Aargau), and the Zurich Region (Zurich). Second, for each regional grouping, the communities were distributed into five strata according to their percentage of foreign nationals (percentage of foreign nationals: very low < median minus 2 standard deviations; low = median minus 2 standard deviations to median minus 1 standard deviation; middle = median minus 1 standard deviation to median plus 1 standard deviation; high = median plus 1 standard deviation to median plus 2 standard deviations; very high > median plus 2 standard deviations). To maximize the difference in migration statuses, the 'middle' strata was not used in the sample recruitment (see **Figure 5**). Third, for each regional grouping, municipalities were randomly

drawn from each stratum in the four regional groupings. For each municipality all schools were sought out through an internet search and randomly listed in an Excel file. Using the Excel file, a team member requested permission from the principal of the uppermost school by email. If principals did not respond to our email, the team member called them again a week later by telephone. If the uppermost school of a municipality declined to participate in our study, the second school of the municipality on the Excel list was approached, and so forth. This process was repeated until consent to participate was given for one fifth-grade class of a school in the municipality, or until the last school declined to participate. A requirement for participating in the study was that all students in the class belonged only to the fifth grade. This was necessary, as mixed grade classes might experience a half-class and/or small group teaching setting more often. This could result in a different social structure among the students. An additional convenience of this age group was that in the chosen regions in Switzerland, students do not face a school transition after fifth grade (Wolter et al., 2018). 42 of the 393 contacted schools were not able to participate in our study because they did not fulfill this criterion (see **Figure 5**). A further 317 of the total of 393 schools contacted were already occupied by other studies or projects in the year of study and, thus, did not wish to participate in the present study. Accordingly, with 34 participating classrooms from 351 eligible schools contacted, the participation rate on the school level was a low 9.7 percent. In total, it was necessary to contact schools within 62.9 percent of the total of 466 municipalities in the chosen strata to reach a sample size of 34 schools (see **Figure 5**). This might serve as a further indication that despite best intentions, by implementing a random stratified sampling process, the final sample of this study is not representative of all schools in the chosen region of Switzerland. A similarly low participation rate on the school level has also been observed in other studies in educational research conducted in Switzerland that are not associated with compulsory monitoring (Russo, 2019).

Figure 5

Recruitment Process.



3.3.2 Missing data

The number of students in all participating classes was 702. Seventy-one students did not want to participate in the study (10.1% of all students). Accordingly, our sample comprises 631 students. Classes consisted of 11 to 26 students (M = 20.65 students, SD = 3.34). An overall participation rate of 89.9% of the students is high in comparison to the mean participation rate of 65.5% found in school-based case studies in which parents had to agree actively to their children's participation in a study (Blom-Hoffman et al., 2009). The number of students per class that did not receive parental consent to partake in our study varied between zero (0.0%) and seven (29.2%). M = 2.00 students, *mean percent* = 9.8% of all students in class.

Some participating students occasionally missed a lesson or questionnaire for various reasons (illness, medical appointments, special educational needs class, etc.). Accordingly, twelve students did not answer the general student questionnaire. In addition, 85 possible lesson observations and related lesson questionnaires from individual students are missing. This missing data from the students was the result of coincidence (illness, medical appointments, SEN class, etc.) and cannot be systematically attributed to another variable under study.

Additionally, some data is missing because of the research design of the overall project 'Klassenteams'. In the project, the state measures related to a lesson by a teacher were only assessed once per teacher and, thus, if two subjects of interest (e.g., German and English) were taught by the same teacher, the students would only be observed in one of the two subjects and not in both subjects. As this missing data on the student level depends only on the class, it can only be considered missing at random in regard to the constructs under study.

In order to address the missing data, a maximum likelihood estimation approach employing robust standard errors (MLR) was used in the proposed structural equation models in Mplus (Little & Rubin, 2002). In regard to the social network analysis, Robins et al. (2004, p. 257) showed in a simulation study "that treating a sizeable proportion of nodes as non-respondents may still result in estimates, and inferences about structural effects, consistent with those for the entire network".

3.3.3 Sample description

The final sample consisted of 34 Swiss fifth-grade classes and their teachers in the subjects German, English, Social and Natural Sciences, and Arts and Crafts, and the special needs teachers. In total 126 teachers and 631 students participated in our study.

The student sample of this study consisted of 307 girls (49.6%) and 311 boys (50.2 %). One student did not indicate his / her gender. Students' mean age at the time of the general student questionnaire was $M = 11.4$ years ($SD = 0.47$, 18 students did not indicate their birthday).

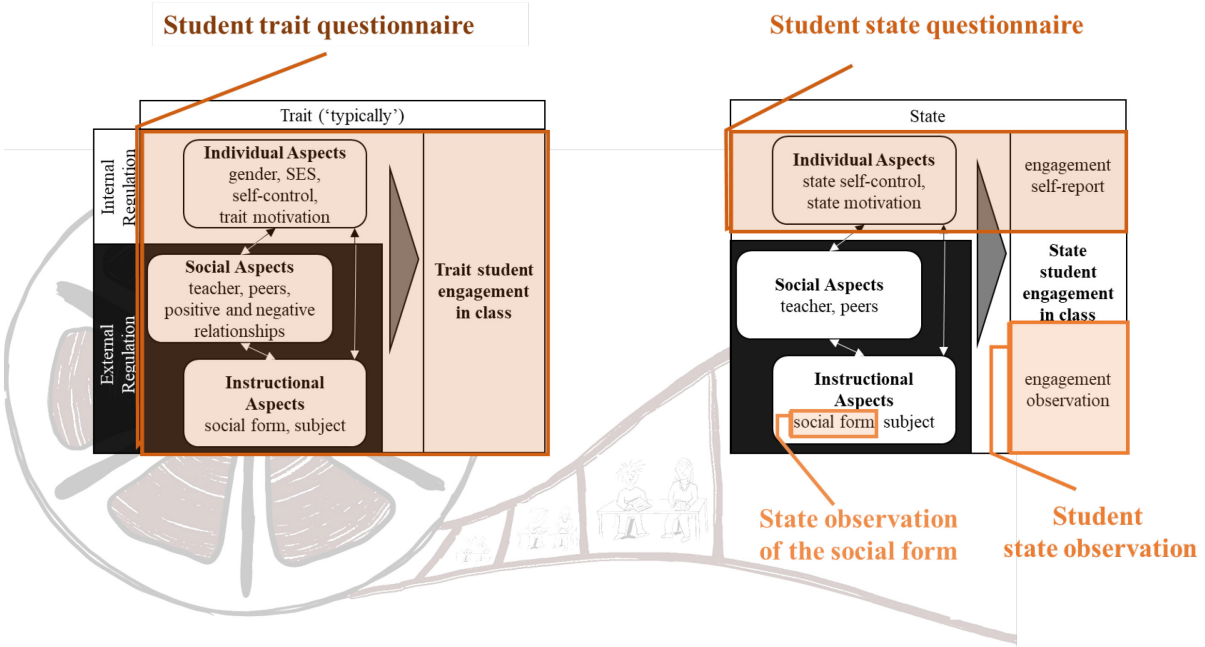
To capture the socio-economic status of the students in our sample, the students' parents' jobs were coded according to the ISCO-08 system (ILO, 2012). The ISCO-08 codes were then further transformed into ISEI-values (Ganzeboom & Treiman, 2019). The mean highest ISEI (HISEI) of both parents lies at $M = 56.48$, $SD = 22.16$ (44 missing observations). In comparison to published HISEI values of PISA (2018) for German speaking municipalities in Switzerland with a mean HISEI of 51.7, this value is significantly higher (one-sample t-test: $t(586) = 5.23$), but it is similar to the published HISEI values from French ($M = 55.7$; one-sample t-test: $t(586) = 0.84$) and Italian ($M = 54.9$; one-sample t-test: $t(586) = 1.71$) speaking municipalities of Switzerland (PISA, 2018).

3.4 Instruments

The instruments used for this dissertation are presented in the following paragraphs. All student related instruments were compiled and tested under the lead of the author of the present dissertation. **Figure 6** gives an overview of how the instruments in the present dissertation are used to measure different aspect of the working model of the dissertation.

Figure 6

Working model of the interplay of internal and external regulation and their joint impact on student engagement in class under consideration of the data collection.



Note. The variables that are indicated in the model but not specifically measured by one of the four described instruments (e.g., which teacher or classmates are present and which subject is observed) are available from the description of the data collection.

Data collection closely followed the working model of this dissertation. Constructs considered more stable (within the timeframe of the data collection) such as external motivation, capacity for self-control, relationships and socio-demographic indicators were only assessed through the trait measure of the student trait questionnaire. Less stable constructs, which might be more dependent on the situation, such as internal motivation and engagement in class were measured with both types of measures: with the trait measure (student trait questionnaire) and with the state measures (student state questionnaire and state observation).

There was a lack of suitable (German) measures for the constructs of interest in this dissertation. The reasons for this could be, on the one hand, that to date there have not been many studies conducted on this age group of students (Godwin et al., 2016) and, on the other hand, that in the literature, student engagement in school is usually defined very broadly, not necessarily

referring to actual student engagement during class (see discussion in section 2.1). Accordingly, German questionnaire instruments (already applied in research projects in the region of German-speaking Switzerland) for older students were chosen, simplified, shortened, and adapted to the present study in order to receive objective, reliable, and valid measurements of the constructs examined. In order to obtain from the trait and state measures comparable measurements of constructs assessed by both instruments, the wording of the items used in the respective measures was kept as similar as possible. Further, concerning the observation measure, there was no suitable instrument for observing all students in a class, as was the aim in the present study. Available instruments focused on single students and/or entailed only very broad categories of on-task versus off-task behavior. Consequently, a new standardized observation instrument was created by the author of the present dissertation. This will be described in section 3.4.3.

After the instruments to answer our research questions had been developed, they were piloted in two phases. First, all instruments were tested separately in six different classes that were not participating in the main study because of the fact that they did not match the inclusion criteria. This first pilot served to test a first version of the instruments: to test whether the students were able to understand the questions in the two questionnaire measures, and whether the duration of the questionnaire measures was suitably adapted for fifth-grade students, and to test the general applicability of the different measures. The results of this first pilot testing helped in better adapting the measures to the target population of study. This was necessary because most measures were originally used with older students and/or did not exist in the present versions. Second, all instruments were piloted in their final versions jointly in two further classes that did not conform to the inclusion criteria of the study. This second pilot served to test the complete procedure of the study, including the final instruments.

The instruments used in this dissertation are outlined in the ensuing sections. First, the two questionnaires, the student trait questionnaire and the student state questionnaire, are presented. Then, the two state observations, the student state observation and the state observation of the social form, are described.

3.4.1 Student trait questionnaire

The student trait questionnaire covers questions relating to more stable constructs and to the students' general perception of the school subjects. The student trait questionnaire mainly assessed stable individual and social aspects affecting student engagement in class, and trait student engagement in class. Students required 15 to 30 minutes to answer the whole questionnaire on paper.

Before students started answering the questionnaire, they were provided with short instructions with example questions. The first sheet of the questionnaire was a cover sheet on which the students' full names were written to link the individual student correctly with the questionnaire containing his/her participant code. Students were instructed to tear off the cover sheet at the start of the questionnaire and put it aside. The further pages only contained each student's participant code. Additionally, a member of the research team explained that nobody except the research team would see the students' answers and that all data collected would only be analyzed in an anonymized version.

The student trait questionnaire consisted of four different question sections (socio-demographics, self-control, relationships, and class-related motivation and engagement), described in the following. The original (German) version of the general student questionnaire is reproduced in Annex C.

3.4.1.1 Socio-demographics

In the first section, students were asked to provide socio-demographic information about themselves and their families. This part comprised questions about the students' gender, birthdate, and parental occupations. All these items were versions adapted from Lenski et al. (2016).

In order to receive an indicator of the socio-economic status of a student, the occupations of all mothers and fathers were coded into International Standard Classification of Occupations (ISCO-08) values and then converted into International Socio-Economic Index of occupational status (ISEI) values using the approach proposed by (Ganzeboom & Treiman, 2019). Further, for each child the higher value of both their parents' ISEI values was chosen to receive a student's highest ISEI (HISEI) value. A description of the sample HISEI values was already provided in section 3.3.3 above.

3.4.1.2 Self-control

In the second section, a scale consisting of six adapted and simplified items on impulsivity / hyperactivity and inattention was used (adapted from the student self-evaluation form from the Conner's 3 scale developed by Lidzba (2013); e.g., "Usually, I get distracted by things happening around me." 1 = I totally disagree – 6 = I totally agree).

For the analyses, all items of the scale were reversed. Accordingly, a high value in the self-control scale signified that the student possessed a high level of self-control (M = 4.36, SD = .90, *Cronbach's Alpha* = 0.801, N = 608).

3.4.1.3 Relationships

In the third section, on the one hand, students were asked to nominate their best friends in class ("Which students are your best friends in the classroom? Name between zero and five children."). On the other hand, they were asked to nominate students next to whom they did not

want to sit during class ("Next to which student(s) would you least like to sit? Name between zero and five children."). Both items were adapted from CILS4EU (2016). All student names were recoded into the student codes of the nominated students to anonymize the analysis procedure.

3.4.1.4 Class-related motivation and engagement

In the fourth section of the questionnaire, the students were asked about their class-related motivation and engagement in each subject (in the following order: German, Arts and Crafts, Social and Natural Sciences, and English). The following scale statistics were calculated from all student ratings. Accordingly, given the total student trait questionnaire sample size of 619 students and four observations (subjects) per student, the overall total sample size *n* was 2,476 observations.

Trait engagement scale was measured with three items (e.g., "In the school subject German, I am often occupied by unrelated things." 1 = I totally disagree – 6 = I totally agree; adapted from Neuenschwander et al. (2013)). For the analyses, all items of the scale were reversed. Accordingly, a high value in the engagement scale signified that the student indicated that they were highly engaged during lessons (*M* = 4.47, *SD* = 1.16, *Cronbach's Alpha* = 0.838, *N* = 2,430).

Trait intrinsic motivation scale was measured with three items (e.g., "I have fun in the school subject German." 1 = I totally disagree – 6 = I totally agree; adapted from Ramm et al. (2006) and Neuenschwander et al. (2013), (*M* = 4.24, *SD* = 1.41, *Cronbach's Alpha* = 0.942, *N* = 2,451).

Trait adult-related extrinsic motivation scale was measured with three items (e.g., "In the school subject German, I make an effort, in order that my parents and/or my teacher praise(s) me" 1 = I totally disagree – 6 = I totally agree; adapted from Neuenschwander et al. (2003), (*M* = 3.18, *SD* = 1.38, *Cronbach's Alpha* = 0.783, *N* = 2,437).

Trait subjective class-engagement norm scale was measured with three items (e.g., "In the school subject German, some student(s) are repeatedly disturbing class" 1 = I totally disagree – 6 = I totally agree; adapted from Neuenschwander (1998)). For the analyses, all items of the scale were reversed. Accordingly, a high value in other students' engagement scale signifies that the student indicated that the class in general participates well during lessons (M = 3.74, SD = 1.24, *Cronbach's Alpha* = 0.800, N = 2,460).

This scale was purposely placed after the 'trait engagement scale', on which students rated their own engagement during class. The reason was to avoid students confounding their own engagement rating with the rating of their classmates' behavior by taking into account the part-whole contrast effect (Schwarz et al., 1991). Research on the part-whole contrast effect states that if two "questions are perceived as belonging together, […] conversational norms of non-redundancy prohibit the repeated use of information that has already been provided in response to the specific question when making the general judgement" (Schwarz et al., 1991, p. 3). Accordingly, if students are first specifically asked about their own engagement and second more generally about their classmates' engagement, they should automatically avoid integrating their own behavior when answering the question about their classmates.

All Cronbach's Alphas reached acceptable to excellent values, even when separating the scales into the different subjects. In addition, the values of Skewness and Kurtosis of all scales (also when separating the scales by subject or teacher type), were good (< 1). The statistics separated by subjects and by teacher function, are listed in **Table 4** and **Table 5**.

Table 4

Descriptive statistics of the student trait questionnaire separated by subject.

	Scale	Internal motivation	External motivation	Perception of classmates' engagement	Engagement
Arts and Crafts	***M***	4.68	3.15	3.54	4.66
	SD	1.23	1.41	1.08	1.10
	Cronbach's α	0.901	0.787	0.694	0.849
	N	614	608	612	605
English	***M***	3.71	3.42	4.01	4.32
	SD	1.26	1.28	1.23	1.06
	Cronbach's α	0.942	0.800	0.839	0.835
	N	612	608	611	611
German	***M***	3.71	3.42	4.05	4.32
	SD	1.26	1.28	1.19	1.06
	Cronbach's α	0.946	0.716	0.820	0.763
	N	614	610	612	604
Social and Natural Sciences	***M***	4.68	3.15	3.35	4.66
	SD	1.23	1.41	1.30	1.10
	Cronbach's α	0.961	0.802	0.783	0.884
	N	611	611	610	610

Table 5

Descriptive statistics of the student trait questionnaire separated by the function of the teacher teaching the lesson observed.

	Scale	Internal motivation	External motivation	Perception of classmates' engagement	Engagement
Class teacher	***M***	4.24	3.00	3.93	4.34
	SD	1.53	1.36	1.21	1.24
	Cronbach's α	0.945	0.785	0.838	0.874
	N	721	719	723	716
Subject teacher	***M***	4.24	3.00	3.50	4.34
	SD	1.53	1.36	1.32	1.24
	Cronbach's α	0.949	0.789	0.811	0.837
	N	905	899	902	894

3.4.2 Student state questionnaire

The student state questionnaire covered questions related to the current lesson that had just been completed (see **Figure 6**). Students needed a maximum of five minutes to answer the whole questionnaire. As was the case with the student trait questionnaire, students filled out this questionnaire on paper. It also contained a cover sheet on which the students' full names were written. We instructed the students to tear off this page at the start of the questionnaire and put it aside. The further pages only contained the student's participant code. As the students had already answered the similar, but longer, general student questionnaire a week before, only very brief instructions were necessary this time.

The scale statistics for the variables of the student state questionnaire were calculated on all student ratings as below. The statistics separated by subjects and by teacher function are depicted in **Table 6** and **Table 7**. The original (German) version of the student state questionnaire for the subject German is reproduced in Annex D. The questionnaire forms for the different

subjects only differed in regard to the footnote containing the name of the subject to be able to distinguish the multiple observations of a student.

Students answered the following scales relating to the lesson:

State intrinsic motivation scale was measured with three items (e.g., "I had fun during this lesson." 1 = I totally disagree – 6 = I totally agree; adapted from Ramm et al. (2006) and Neuenschwander et al. (2003), $M = 4.33$, $SD = 1.36$, *Cronbach's Alpha* = 0.847, $N = 1619$.

State self-reported engagement scale was measured with three items (e.g., "During this lesson, I was often occupied by unrelated things." 1 = I totally disagree – 6 = I totally agree; adapted from Neuenschwander et al. (2013). For the analyses, all items of this scale were reversed. Accordingly, high values in the engagement scale signified that students indicated that they had participated well during the lesson ($M = 4.81$, $SD = 1.11$, *Cronbach's Alpha* = 0.813, $N = 1600$).

Skewness and Kurtosis of scales (also when separating the scales by teacher type) were acceptable (around 1.00). However, when separating the scales by subject, the state engagement scale in English has a little higher Skewness and Kurtosis (*Skewness* = -1.15, and *Kurtosis* = 1.36). The statistics separated by subjects and by teacher function can be found in **Table 6** and **Table 7**.

Table 6

Descriptive statistics of the student trait questionnaire separated by subject.

	Scale	state motivation	state participation
Arts and Crafts	***M***	4.57	4.47
	SD	1.35	1.29
	Cronbach's α	0.827	0.848
	N	562	556
English	***M***	4.05	4.98
	SD	1.35	1.00
	Cronbach's α	0.858	0.810
	N	382	379
German	***M***	3.99	5.04
	SD	1.39	0.88
	Cronbach's α	0.864	0.723
	N	294	292
Social and	***M***	4.50	5.00
Natural Sciences	***SD***	1.27	0.93
	Cronbach's α	0.828	0.760
	N	381	373

Table 7

Descriptive statistics of the student state questionnaire separated by the function of the teacher teaching the subject during the lesson observed.

	Scale	state motivation	state participation
Class teacher	***M***	4.28	4.98
	SD	1.35	0.94
	Cronbach's α	0.841	0.764
	N	719	711
Subject teacher	***M***	4.36	4.68
	SD	1.37	1.21
	Cronbach's α	0.852	0.837
	N	900	889

3.4.3 Student state observation of on-task engagement

In addition to the self-assessment measure of student engagement in the student state questionnaire, a standardized observation of student on-task engagement during the lesson was conducted (see **Figure 6**).

3.4.3.1 Procedure

For the student observation, a direct observation approach (compared to a video observation approach) was chosen for three main reasons. Firstly, Curby et al. (2016) show that in a classroom setting both observation approaches are similarly reliable, although the direct observation approach is more reliable when it comes to rating a classroom's negative climate. Secondly, an attempt was made to observe the lessons in the context of their daily routine, which was kept as normal as possible. Because this might include multiple places of studying (e.g., at desks, at other places in the classroom, and at working stations outside the classroom), a video of the students' behavior would have been very disruptive and impractical to implement.

To observe student engagement behavior in lessons of the different subjects of 40 minutes each, a 15-second momentary time sampling approach was employed. The approach of 15-second momentary time sampling means that every 15 seconds an observation is made and documented. This approach was chosen because it had achieved the best approximation of student engagement in multiple comparative studies using different observation approaches (e.g., Briesch et al., 2015; Gardenier et al., 2004). The author of the present dissertation developed the practical implementation of the 15-second momentary time sampling approach. In the following, a detailed description of the procedure used for the standardized student observations is provided (the corresponding manual used for observer training can be found in the observation manual in Annex E).

The order of observations was random, corresponding to the two last digits of the participant codes (ranging between 01 and 28). To identify the students during the observation, each student was wearing an armband on both arms, similar to that of a sports captain. Each armband had a number between 1 and 28 and a color: the numbers 1 to 5 were blue, the numbers 6 to 10 were red, the numbers 11 to 15 were yellow, the numbers 16 to 20 were green, and the numbers 21 to 28 were white. Such a color scheme was chosen to be able to identify students more quickly during a lesson.

The 15-second observation intervals were structured as follows: First, the number and color of the armband identified the current target student. Second, on the vibration signal of the interval timer (Gymboss® Intervall Timer) the current behavior of the target student was observed and categorized. Third, the observed behavior of the target student was entered into the form. Then the next student on the list was targeted.

The observations were recorded in an online questionnaire form generated with the software tool Unipark (www.unipark.com). The first page of the questionnaire served to note information on the lesson which was about to be observed (lesson code, observer, subject, place, date, time, commentaries). The second and following pages served to mark the observations of the individual students according to the defined categories of engagement behavior (e.g., active on-task, see section 3.4.3.2 for the categories used in the observation). At the end of the form, there was an open field for commentary to note any special events that occurred during the lesson.

If a student was absent during the observed lesson, the observer jumped to the next student present. This was often the case during Arts and Craft lessons, during which usually only half the students were present. If the observer did not find this student within the limited time available, the observer jumped to the next student for the following observation interval. This happened, for example, if a student had to leave the classroom during a lesson to get something

from another teacher, if the students were moving around between multiple places during one lesson, or if a student had to leave class early. The average number of observations per student differed depending on whether the lesson was in a full-class or half-class setting. In German (M = 11.43, SD = 7.46, N = 286), English (M = 7.91, SD = 3.77, N = 347) and Social and Natural Sciences classes (M = 9.27, SD = 4.34, N = 374) about half as many observations were made on average as were made in Arts and Crafts classes (M = 19.95, SD = 9.24, N = 595).

To use the online questionnaire form, a modem compatible with a prepaid internet card was necessary to establish an internet connection. Huawei LTE Hotspot E5577Cs-603 modems in combination with Samsung Tablets (Samsung GALAXY Tab 10.1 GT-P7510) were used to access the online questionnaire forms. If there was no internet connection available in a school, or when a technical problem occurred with the online questionnaire form (e.g., a system update), a paper version of the observation form was used during the lesson.

The observers always prepared all necessary materials before entering the classrooms. Whenever possible, the armbands were distributed to the students while they were entering the classroom and/or before the lesson started. As soon as all students were wearing their armbands, the observers positioned themselves so that they would not disrupt the class, and would be able to see as many students as possible. The standardized student observations started parallel to the lesson and ended after 40 minutes. Then the students answered the student post-lesson questionnaire. At the end of the lesson, the observer collected the armbands and the student post-lesson questionnaires and thanked the students and teacher for their participation.

3.4.3.2 Observation categories

The categories used to describe student engagement behavior were adapted from Shapiro's Behavioral Observation of Students in Schools (BOSS; Shapiro, 2013). The BOSS observation system was chosen as a base because it allows for the subcategorization of on-task and off-task

behaviors, and thus the coding of the behaviors leads to a smaller information loss than is the case with other observation categorizations. This was desirable for the overall project 'Klassenteams'. Nevertheless, the categorization definitions used in the present study are not completely identical to the ones proposed by Shapiro (2013). Namely, in the present study the act of collecting and preparing study materials when expected to do so, was also coded as an 'on-task active' behavior, while Shapiro (2013) coded this kind of behavior as an 'off-task motoric' behavior. Thus, the definition of the categories used in this dissertation are presented in the following paragraphs.

Three main categories of behavior were rated: 'on-task', 'off-task', and 'other'. Each behavior category had several sub-categories, which are described in the following paragraphs.

On-task behavior covered all behavior corresponding to the behavioral expectations the teacher had for the student. It was sub-categorized into 'active' and 'passive' on-task behavior. Active on-task behavior describes observable actions (e.g., answering a question, writing down words, singing, preparing materials, and reading). Passive on-task behavior related to behavior that occurred when a student was participating in class but was not actively performing an observable action (e.g., listening to other students/the teacher, watching other people performing an action). To distinguish between passive on-task and passive off-task (see next paragraph), the line of vision was taken as an aid. If the observed student was looking at the place where the key action was taking place (e.g., teacher or students explaining something), we coded the passive behavior as on-task. If the student was looking at something else (e.g., out of the window), we coded the behavior as passive off-task.

Off-task behavior comprised behavior not corresponding to the behavioral expectations of the teacher. It was sub-categorized into 'verbal', 'motor' and 'passive' off-task behavior. Verbal

off-task behavior related to students showing any undesirable verbal behavior (e.g., inappropriate sounds, chatter with other students). Motor off-task behavior corresponded to students showing any undesirable motoric behavior (e.g., playing with pens, rocking their chairs, fidgeting, touching other people in class). Passive off-task behavior describes the case when a student is not following the course of action in class but is not showing any active disruptive behavior (e.g., sleeping, staring out the window, watching other students´ off-task behavior).

'Other' behavior relates to situations when the situation did not allow for the coding of on-task or off-task behavior. This category contains the sub-categories 'no task' and 'no code'. No task describes situations when the teacher did not verbalize any behavioral expectation of the student. We used 'no code' when the observer was not able to categorize the observed behavior, and we skipped the observation (missing) if a student was absent and/or the observer was not able to find the student in the classroom.

When necessary, it was possible for an observer to code the behavior of a student into multiple categories. This was sometimes the case during Arts and Crafts lessons, when the students were actively working on their projects (on-task active) and simultaneously talking with their co-students, although this was not allowed (off-task verbal).

3.4.3.3 Observer training and interrater reliability

The training of observers followed three steps. First, the observers used the observation manual (Annex E) to learn the observational procedure and categories in theory. Second, a trained observer discussed the contents of the manual with the trainees and answered their questions. Third, the trainee accompanied a trained observer on multiple observations and coded the observations in parallel. After the observation, the trained observer would discuss the observations and difficulties that occurred with the trainee.

Seven interrater observations with two trained observers were conducted. In the case of interrater observations, both observers started their observations simultaneously. From time to time, the observers checked whether they were still observing the same student at the same time. This was important, as sometimes when shifting from the last student in an observation round to the first student in the next observation round, the two observers did not handle switching the form at the same speed and, accordingly, they would not observe the same student at the same time until they recalibrated the simultaneous nature of their observations. This problem happened from time to time during interrater observations. In observations 4 and 5 the asynchrony of observers mentioned happened especially frequently. Accordingly, here the interrater reliability is a little lower than in the other observations. Interrater reliability was calculated using Cohen's Kappa Coefficient. The mean Cohen's Kappa of all seven interrater observations was $\kappa = .676$, corresponding to substantial agreement (Landis & Koch, 1977). Detailed statistics on all interrater observations, presented separately, can be found in **Table 8**.

Table 8

Interrater reliability calculations of the standardized observations.

	n ratings	***% agreement***	***Kappa***	***asymptotic SE***	***approx. t***	***approx. p***
1	1899	89.6	0.757	0.027	32.990	< 0.0001
2	2299	95.3	0.824	0.031	39.542	< 0.0001
3	3099	93.8	0.761	0.027	42.372	< 0.0001
4	2599	95.2	0.285	0.049	17.582	< 0.0001
5	1909	86.2	0.440	0.035	19.229	< 0.0001
6	1649	88.4	0.748	0.029	30.418	< 0.0001
7	3100	96.2	0.914	0.020	50.913	< 0.0001
Mean	2365	92.1	0.676	0.031	33.292	< 0.0001

Note. In cases 4 and 5 the two observers' simultaneous nature of observing the same student was not as good as in the other cases. This might be the reason behind the lower Kappa values.

3.4.3.4 Data preparation and descriptive statistics

In the raw data, the observations of all students present in a lesson corresponded to a set of observations. During the data cleaning process, the observation sets were broken down to the student level: for each student, the sum of all observations per on-task and off-task observation category was calculated. In addition, for each student the number of observations in all on-task and off-task categories was calculated. Those two student values served to calculate a relative value per observational category *k* for each student *i* present in a lesson:

$$\text{‘relative value in category k’}_i = \frac{\text{‘absolute frequency of observations in category k’}_i}{\text{‘total number of observations over all categories’}_i}$$

Across all lessons, the mean relative value of on-task behavior was $M = 0.82$, $SD = 0.21$, $N = 1{,}553$. This (high) mean relative value of 82% on-task behavior corresponds with the observations of earlier studies, which found 60% to 93% on-task behavior (Helmke & Renkl, 1992). The mean relative value of off-task behavior was $M = 0.18$, $SD = 0.21$, $N = 1{,}553$ and the mean relative value of mixed coded behavior was $M = 0.01$, $SD = 0.03$, $N = 1{,}553$. As there were only very few mixed codes (especially when separating them into the different possible mix-categories), they were not considered for further analyses. A detailed overview of the descriptive values for the relative values of all behavior categories can be found in **Table 9**.

Table 9

Descriptive values for the relative values of all behavior categories (N = 1,602).

	on-task			off-task			
	active	**passive**	**total**	**verbal**	**motoric**	**passive**	**total**
M	0.82	0.00	0.82	0.05	0.07	0.05	0.18
SD	0.21	0.03	0.21	0.11	0.13	0.12	0.21
Skewness	-1.33	21.96	-1.33	2.87	2.92	3.40	1.41
Kurtosis	1.53	569.06	1.51	11.57	11.25	16.11	1.83

The distributions of the total proportion on-task and total proportion off-task scales are not optimal, but are close to the value of 1. The respective subscales, however, generally possess rather high values of Skewness and Kurtosis. In this dissertation, accordingly, only the proportion of total on-task behavior is used in the analyses.

For the analyses, the range of the observational on-task measure was normalized to the range 1 to 6 of the other continuous variables in the model via min-max normalization (Han et al., 2011), as this was necessary for the structural equation models in order to assure model fit:

$$x_{i,neu} = \frac{xi - \min(x_i)}{\max(x_i) - \min(x_i)} * [max(x_{i,neu}) - \min(x_{i,neu}) + \min(x_{i,neu})]$$

3.4.4 State observation of the social form

In parallel to the student state observation, a state observation of the social form took place using a second observer. This observation was conducted with an event sampling approach: whenever the social form changed within the lesson, the observer would note which type of social form was starting. The types of social forms were defined in accordance with those of (Lotz et al., 2013). In comparison to the research of Lotz et al. (2013), the project 'Klassenteams' changed the term 'public teaching' (Öffentlicher Unterricht) into the term 'plenum' (Plenum) and did not include the term 'station work' (Stationsarbeit). Accordingly, there was a differentiation between the following contexts: plenum (circle versus seats), single, partner, group work and other social forms (transitions, breaks, no code). A detailed description and definition of each social form, including starting and ending criteria, can be found in Kunz Heim et al. (nd).

Seven interrater observations with two trained observers were conducted (analogous to the interrater observations in regard to the student state observation described in section 3.4.3.3). Interrater reliability was calculated using Cohen's Kappa Coefficient. The mean Cohen's

Kappa of all 10 interrater observations was $\kappa = 0.815$, corresponding to substantial agreement (Landis & Koch, 1977). Detailed statistics on all interrater observations, presented separately, can be found in Kunz Heim et al. (nd).

For the further analyses of each lesson, the relative frequency of the occurrence of each social form in this lesson was computed.

3.5 Overview of data analysis

3.5.1 Assumptions regarding causality

As stated earlier, the data used in this dissertation was collected using a cross-sectional approach (see procedure in section 3.2). Nevertheless, as the data was composed of multiple measurements, collected over two weeks, a certain order of measurements occurred. This sequence of measurements was, together with theoretical reflections discussed above, taken into account in formulating statistical models requiring the assumptions of variables predicting other variables. Accordingly, measurements of variables taken earlier (e.g., trait measurements) are usually placed before measurements of variables taken later (e.g., state measurements) in the logic of the directionality of the model. Nevertheless, as stated in the discussion of the theory, a one-directional causality or predictive value regarding the long-term relationships of variables is not assumed and cannot be tested.

According to Hammerton and Munafò (2021, p. 564), "approaches to causal inference may be broadly divided into two kinds – those that use statistical adjustment to control confounding and arrive at a causal estimate, and those that use design-based methods to do so". Hammerton and Munafò (2021, p. 564) propose that "three types of bias can arise in observational data": "confounding and reverse causality bias", "selection bias", and "measurement bias". In this dissertation each of these biases is tackled in one of the ways promoted by the authors

(Hammerton & Munafò, 2021). The confounding and reverse causality bias is handled by considering multiple confounders found in prior research, and in theoretical models in the analytical models, and by respecting the order of data collection. The selection bias is handled by the attempt to achieve a random stratified sample of classes (see section 3.3) and by applying a maximum likelihood estimation approach, employing robust standard errors (MLR) to address missing data (see section 3.3.2). Furthermore, the measurement bias is tackled by triangulating student engagement with three different instruments (see section 3.4). Accordingly, while a strict, one-directional causality is not assumed, the present work still contributes to a better understanding of student engagement and contributes to future experimental research regarding student engagement in class. As Hammerton and Munafò (2021, p. 575) note, "the limitations of observational data for causal inference are well known. However, the thoughtful application of multiple statistical and design-based approaches, each with their own strengths and weaknesses, and in particular sources and directions of bias, can support stronger causal inference through the triangulation of evidence provided by these". Such a triangulation of causal effects is also promoted by Grosz et al. (2020, p. 1243), who posited that there is a "taboo against explicit causal inference in nonexperimental psychology".

3.5.2 Data analysis approach

This dissertation uses a quantitative data analysis approach. The data analysis methods used correspond to each of the research questions. **Table 10** gives a brief overview of the three research questions, the conceptual focus in regard to the working model, and the corresponding type of statistical data analysis.

Table 10

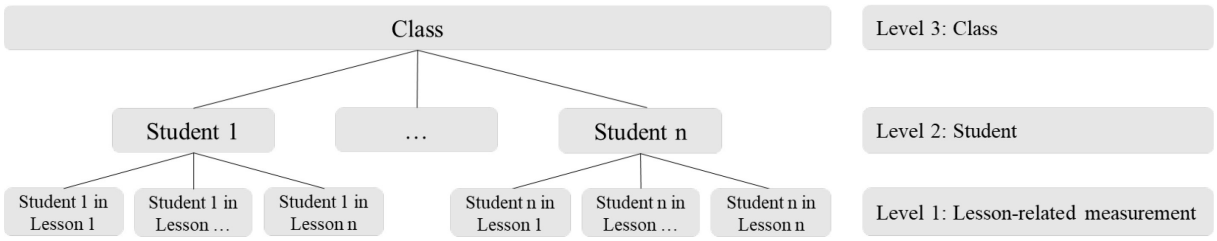
Research questions and corresponding type of statistical data analysis.

	Research question	Conceptual focus	Type of data analysis
1	How do the different measures of student engagement during class (trait vs. state, self-view vs. other-view) relate?	Student engagement	Multilevel Structural Equation Modelling
2	How are motivation and self-control associated with student engagement during class?	Individual	Multilevel Structural Equation Modelling
3	How are student motivation and engagement associated with the relationship structure in class?	Social context	Exponential Random Graph Analyses with Meta-analysis

A particularity of the present data is its hierarchical nesting on three levels. On the lowest level (level 1) lie the multiple lessons during which students were questioned and observed. These lesson-related measurements are nested within each student on the middle level (level 2). Furthermore, students are part of a class (level 3; see **Figure 7**).

Figure 7

Hierarchical nesting of the present data.



The nesting is hierarchical, meaning that there is a hierarchical ordering of the three levels in that elements on level three (the school classes) contain a set of elements on level two (the students belonging to a school class). Further, each element on level two (the students belonging to each of the school classes) contains a set of elements on level one (the lesson-related measurements belonging to a student and belonging to a class). In this reasoning, a specific lesson-

related measurement can only belong to one student and a specific student can only belong to one (and not multiple) classes.

Research questions one and two consider this nesting by using a multilevel structural equation approach. Research question three considers the nesting and the friendship structures within each class by using a social network analysis approach. The social network analysis approach allows for a consideration of not only class membership, but also student relationships within a classroom. In regard to educational sciences, social network analysis can still be considered a novel analytical approach (Mejeh & Hascher, 2021).

To address data limitations (missing data as discussed in section 3.3.2 as well as the finding that some scales were slightly skewed, as discussed in section 3.4.1), a maximum likelihood parameter estimate with robust standard errors (MLR) was used in all structural equation models (Little & Rubin, 2002).

Data management for all analyses was performed using the R software environment (R-Core-Team, 2020). Data preparation and analysis for research questions one and two were conducted with MPlus Version 8.5 (Muthén & Muthén, 2017). Data preparation and analysis for research question three were performed with XPnet (Wang et al., 2009) and the R software environment (R-Core-Team, 2020).

3.5.3 Data preparation for the analysis of research questions one and two

For the analyses of research questions one and two, which used a multilevel structural equation approach, the data needed to be preprocessed in order to handle the three-level hierarchical nesting of the data.

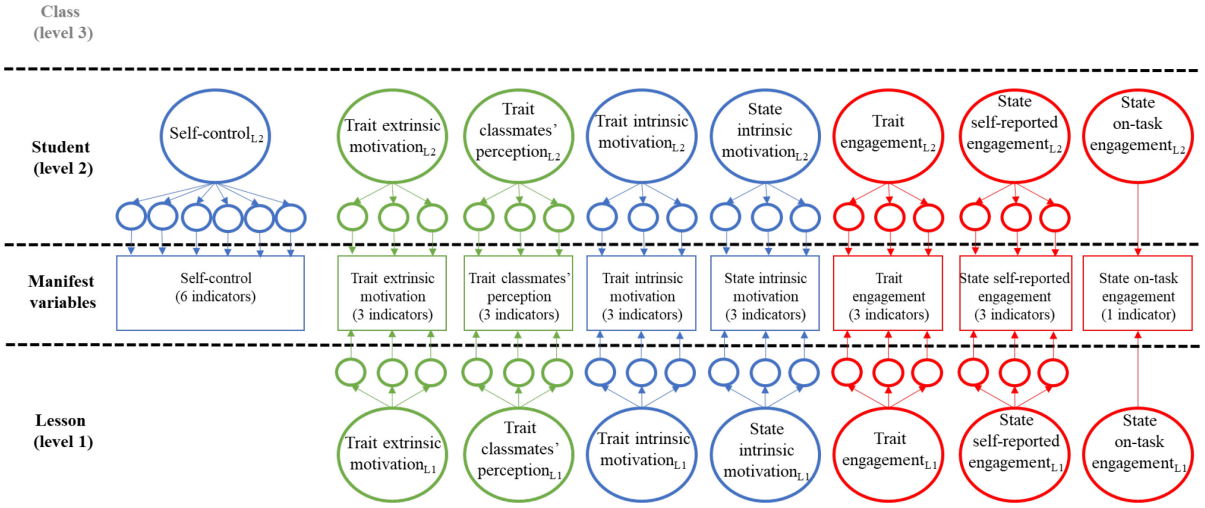
For the analyses, the three-level structure was not optimal because three-level structural equation modelling requires a large sample on all levels of analysis when investigating complex model and/or smaller effects (Kerkhoff & Nussbeck, 2019). According to the recommendations

of Kerkhoff and Nussbeck (2019), the present sample is too small in regard to levels 3 (class) and 2 (student) for the purpose of investigating effects on the class level (level 3) and in order to avoid estimation bias.

The preprocessing of the data consisted of separating the variance in the lesson-related measurements for each student into two parts. The first part remains on level 1 (lesson), representing lesson-specific parts of the variance of the measurement, while the second part consolidates student-related parts of all lesson-related measurements of a student and, thus, manifests as a latent aggregation on level 2 (student). This decomposition of the variance was implemented by building doubly latent two-level measurement models, including level 1 - lesson and level 2 - student (Marsh et al., 2009; Muthén, 1994; Muthén & Muthén, 2017; Preacher et al., 2016). These latent factor scores were later used to calculate the analyses in regard to research questions one and two, which are explained in detail in sections 4.2 and 5.2. The measurement model is depicted in **Figure 8**.

Figure 8

Measurement model in regard to the hierarchical nesting of the present data.



The standardized factor loading estimates as well as the model fit statistics for the two-level examination of the measurement models can be found in **Table 11**. The examination of the measurement models of the latent variables indicated a good fit in regard to the criteria, relative to the sample size (Hair et al., 2006). However, the latent trait extrinsic motivation factor on level 1 and the latent self-control factor on level 2 have a total of three values smaller than the recommended value of 0.5 in the additional goodness of fit measure of average variance explained (Fornell & Larcker, 1981). As the Cronbach's α scores, as indicators of the composite reliability of all scales, are larger than 0.6, "the convergent validity of the constructs is still adequate" according to Huang et al. (2013, p. 219).

Table 11

Standardized factor loading estimates and model fit statistics of the two-level factor analysis (n = 2,476 lesson measurements nested within n = 619 students; all p-values < 0.0001).

			Level 1 - Lesson							Level 2 - Student							
			Motivation				Engagement			Motivation				Engagement			
		Item	1.a	1.b	1.c	1.d	2.a	2.b	2.c	1.a	1.b	1.c	1.d	2.a	2.b	2.c	3
Motivation																	
Trait intrinsic	1.a	1	0.87							0.98							
		2	0.94							1.00							
		3	0.92							0.92							
Trait extrinsic	1.b	1		0.79							0.81						
		2		0.60							0.79						
		3		0.57							0.75						
Trait class-mates' perception	1.c	1			0.68							0.95					
		2			0.83							0.94					
		3			0.64							0.70					
State intrinsic	1.d	1				0.71							0.86				
		2				0.79							0.89				
		3				0.83							0.99				

		Item	Level 1 - Lesson							Level 2 - Student							
			Motivation				Engagement			Motivation				Engagement			
			1.a	1.b	1.c	1.d	2.a	2.b	2.c	1.a	1.b	1.c	1.d	2.a	2.b	2.c	3
Engagement																	
Trait	2.a	1					0.80							0.89			
		2					0.65							0.90			
		3					0.74							0.91			
State self-report	2.b	1						0.71							0.99		
		2						0.69							0.95		
		3						0.68							0.94		
State on-task	2.c								1							1	
Self-control	3	1															0.73
		2															0.61
		3															0.70
		4															0.48
		5															0.63
		6															0.67
Model-fit																	
X^2	873																
df	380																
CFI	0.97																
TLI	0.96																
RMSEA	0.02																
SRMR			Level 1 = 0.038							Level 2 = 0.052							
AVE			0.83	0.43	0.52	0.61	0.54	0.48	-	0.94	0.62	0.76	0.84	0.80	0.92	-	0.41
CR			0.94	0.69	0.76	0.82	0.77	0.74	-	0.98	0.83	0.90	0.94	0.93	0.97	-	0.80

Note. df = degrees of freedom; *CFI* = Comparative Fit Index; *TLI* = Tucker-Lewis Index; *RMSEA* = Root Mean Square Error of Approximation; *SRMR* = Standardized Root Mean Square Residual; *AVE* = Average Variance Extracted; *CR* = Composite Reliability; W = within-group portion of the model; B = between-group portion of the model.

As is to be expected, there are several correlations between the latent factors present. Detailed correlation tables for the variables on the lesson and student levels of analysis are provided in **Table 12** and **Table 13**. The correlation matrix does not contain any unexpected significant

estimates. Further, all correlation values are also smaller than 0.80. Accordingly, there is no indication of multicollinearity found in the correlation matrix.

Table 12

Correlation table on the Level 1 - Lesson with two-tailed estimates (n = 2,476 lesson measurements nested within n = 619 students).

	Motivation				**Engagement**	
	Trait intrinsic	Trait extrinsic	Trait classmates' perception	State intrinsic	Trait	State self-reported
Motivation						
Trait intrinsic						
Trait extrinsic	0.04					
Trait classmates' perception	0.16***	0.03				
State intrinsic	0.38***	-0.03	0.12**			
Engagement						
Trait	0.54***	0.08	0.35***	0.22***		
State self-reported	0.22***	0.18*	0.21***	0.27***	0.28***	
State on-task	0.04	0.05	0.01	0.16***	0.00	0.23***

Note. *indicates $p < 0.05$, **indicates $p < 0.01$, ***indicates $p < 0.001$

Table 13

Correlation table on the Level 2 – Students with two-tailed estimates (n = 2,476 lesson measurements nested within n = 619 students).

	Motivation				Engagement		
	Trait intrinsic	Trait extrinsic	Trait classmates' perception	State intrinsic	Trait	State self-reported	State on-task
Motivation							
Trait intrinsic							
Trait extrinsic	0.23**						
Trait classmates' perception	-0.07	-0.24***					
State intrinsic	0.72***	0.13	0.27**				
Engagement							
Trait	0.29**	-0.31***	0.34***	0.33***			
State self-reported	0.51***	-0.14*	0.35***	0.52***	0.72***		
State on-task	0.57**	-0.14	0.48***	0.27	0.34**	0.42**	
Self-control	0.45***	-0.09	0.28***	0.28***	0.63***	0.69***	0.44***

Note. *indicates p < 0.05, **indicates p <0 .01, ***indicates p < 0.001

Additionally, it is interesting to note that the intra-class correlation coefficients (ICC) of the items for trait extrinsic motivation vary between 0.59 and 0.72, indicating a moderate similarity of ratings between lessons, while all the other items show ICCs lower than 0.5, indicating a low similarity between subjects / lessons (Koo & Li, 2016). This can be interpreted as evidence that trait extrinsic motivation (in regard to teacher / parent praise / blaming) is more stable across different situations than the other lesson-related variables (see **Table 14**).

Table 14

Intra-class correlation coefficients (ICC) of the variables.

	Item	ICC
Motivation		
Trait intrinsic motivation	1	0.16
	2	0.16
	3	0.16
Trait extrinsic motivation	1	0.59
	2	0.69
	3	0.72
Trait classmates' perception	1	0.29
	2	0.34
	3	0.42
State intrinsic motivation	1	0.23
	2	0.19
	3	0.22
Engagement		
Trait engagement	1	0.32
	2	0.42
	3	0.42
State self-reported engagement	1	0.26
	2	0.19
	3	0.34
State on-task engagement		0.11

In the following sections, the analysis strategies, the results and the discussion of the results are presented separately for each of the three research questions.

4 Research question one: Triangulation of student engagement

Research question one investigates the relationships between the three different measures (trait student engagement, state self-reported student engagement and state observation of student engagement) used to triangulate student engagement during class. It was expected that the observational measurement of student state on-task engagement during class, in comparison to the other two measurements, mainly captures procedural parts of student engagement. The other two measurements of student engagement during class, as self-assessment measurements, were expected to capture procedural and substantive parts of student engagement during class. Additionally, the three measurements can be distinguished in regard to whether they relate to traits (trait engagement measure) or to less stable states (state on-task engagement and state self-reported engagement measures).

Table 15

Measurements used for triangulating student engagement in class in regard to their procedural versus substantive parts of engagement, and in regard to their stability.

Type of student engagement in focus	**Stability**	
	Trait	***State***
Procedural		State on-task engagement
Procedural and substantive	Trait engagement	State self-reported engagement

4.1 Hypotheses investigated with research question one

Research question one investigates how the different measures of student engagement during class (trait vs. state, self-view vs. other-view) relate. The following hypotheses are associated with this research question.

Hypothesis 1a: Other-person-assessed measurements of student engagement in class are positively associated with self-assessment measurements of student engagement in class.

Hypothesis 1b: Prior measurements of trait student engagement positively predict following measurements of state student engagement in class.

Hypothesis 1c: Self-assessments of trait student engagement better predict self-assessments of state student engagement than other-assessments of state student engagement do.

Hypothesis 3a: Student engagement during class is higher for female than for male students.

Hypothesis 3b: Socio-economic status positively relates to student engagement.

Hypothesis 4b: There is a comparison referent effect related to class membership in regard to student engagement. Students with a similar state on-task engagement rate their self-reported engagement higher or lower than to the class's average student engagement, in line with their perceptions of the class's engagement.

Hypothesis 5b: Student engagement during class is higher for main class teachers than for subject teachers.

Hypothesis 6a: Student engagement differs depending on the subject.

Hypothesis 6b: Student engagement differs depending on the social form.

Hypotheses 1a, 1b, 1c, 3a, 3b, 4b, and 5b allow clear predictions of the effects to be made and accordingly are tested with one-sided *p*-values. All other hypotheses investigated within this research question are tested with two-sided sided *p*-values, as there is scarce inconsistent evidence, and this does not allow clear predictions of the effects to be made.

4.2 Analytical strategy for research question one

In order to investigate all hypotheses, a principal and multiple subsidiary analyses were necessary because of the hierarchical three-level nesting of the data. As discussed in section 3.5, the present data (as well as the chosen type of analysis) does not allow for the use of three-level structural equation models. Accordingly, the examination of the hypotheses needed to be conducted with multiple analyses. The first analysis was conducted on level 2 (students) and level

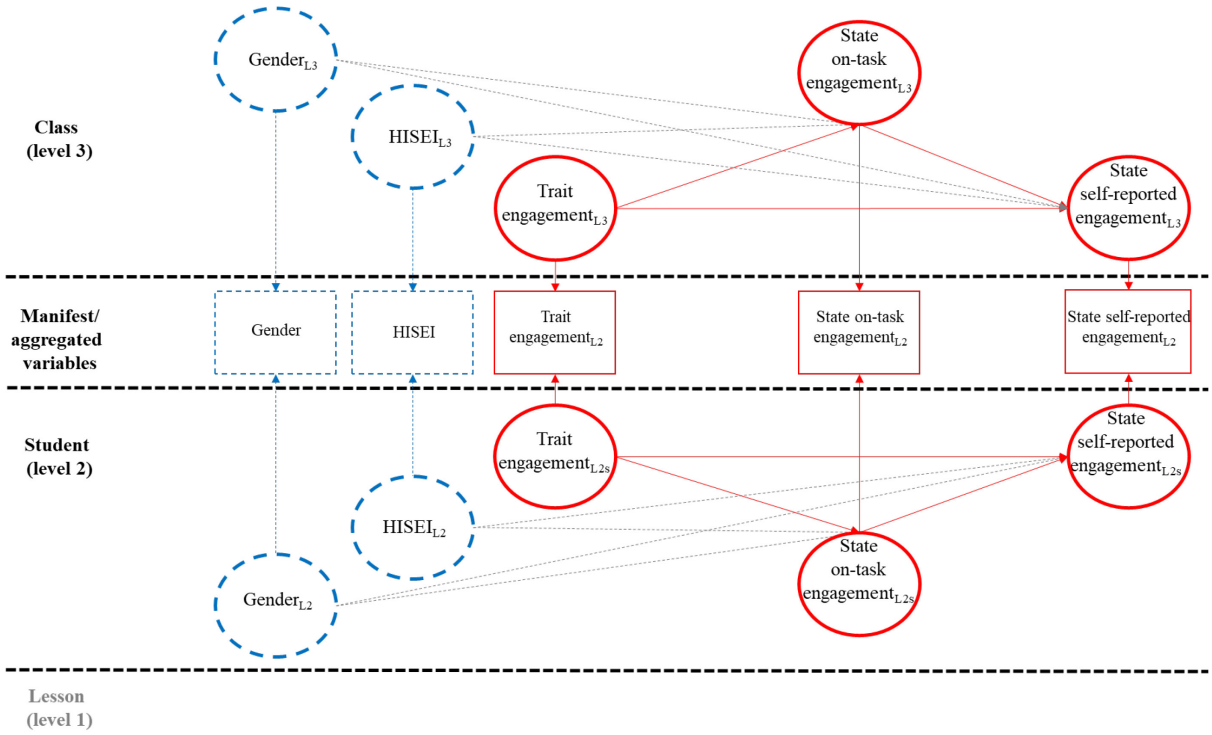
3 (class). The second analysis was conducted on level 1 (lesson) and level 2 (student). Both analyses followed the same two-level structural equation model approach, allowing contextual effects to be examined (Marsh et al., 2009).

In the first analytical model (see **Figure 9**), an investigation was conducted as to what extent the trait engagement measure assessed earlier predicts state on-task engagement, and to what extent trait engagement and state on-task engagement allow state self-reported engagement to be predicted (hypotheses 1a, 1b and 1c). Furthermore, this model enabled an examination of whether a comparison referent effect (contextual effect) of the classes in which the students are nested, analogous to the big-fish-little-pond effect, was present (hypothesis two; Festinger, 1954; Marsh & Hau, 2003; Marsh & Parker, 1984). Note that, in regard to the two measures of state student engagement, it is assumed in the models that the state observation of on-task engagement predicts state self-reported engagement, because the measurement of state self-reported engagement happened after the respective lesson. Additionally, Gender and SES were included in the analytical models as control variables (hypotheses 3a and 3b). As a two-level structural equation modelling analysis, this analysis was conducted not only on the student level 2, but also simultaneously on the class level three. In simplified terms, this analysis can be imagined as similar to conducting the identical multiple regression analyses simultaneously on the student level 2 and the class level 3, while also running analyses of interactions between level 2 and level 3. For the contextual effect, an examination was then conducted of whether the estimates on level 2 (student) differ significantly from the estimates on level 3 (class). For the present analysis, it is preferable to use a multilevel structural equation modelling approach, because for a multiple regression analysis, the variables would need to be aggregated on the class level by hand, for example by calculating the mean value of a variable for all students in a class. This would imply that the values on the class level 3 also contain variance that is not

attributable to the class as a whole, but rather to individual students in the class and, thus, that there is an overlap between the data used on the student level 2 and the class level 3. In the present multilevel structural equation approach, this overlap is avoided, as the approach allows for the division of the variance into student-related and class-related variance (Muthén, 1994; Muthén & Muthén, 2017; Preacher et al., 2016).

Figure 9

Hypothesized two-level structural equation model in regard to student engagement on the student level 2 and class level 3.

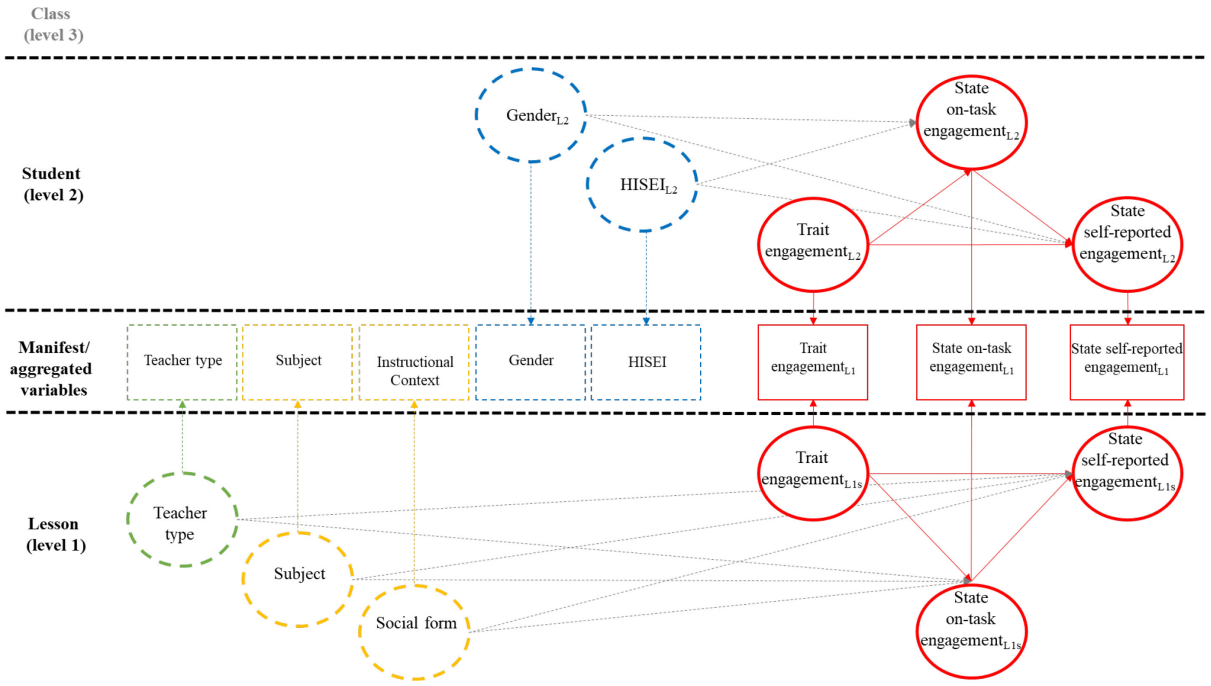


The second analytical model (see **Figure 10**) was conducted in a similar way to the first analysis; however, this time lesson level 1 and student level 2 were taken into consideration. In this model, thus, it was possible to include aspects of the learning situation in the model (hypotheses 5b, 6a and 6b). For this analysis, the subjects were dummy-coded against the reference subject Arts and Crafts. Accordingly, if a predictor subject has a value larger than zero, this means that

generally the engagement in this subject is higher than in the subject Arts and Crafts. Gender and socio-economic status (HISEI) were included in this analytical model as control variables on the student level 2. In this model, which neglected the class level 3, the interdependency of multiple measures of the students in the same class is neglected in order to be able to consider influences on the lesson level. In this second model on the lesson and student levels, there are no hypotheses of contextual effects. Thus, they are not considered.

Figure 10

Hypothesized two-level structural equation model in regard to student engagement on the lesson level 1 and student level 2.



For both analytical models, a Satorra-Bentler scaled X^2 difference test, comparing the current model with the baseline model (Satorra & Bentler, 2010), was conducted to assess model fit. Additionally, model fit was investigated with comparisons to the Akaike (AIC), the Bayesian (BIC), and the Adjusted Bayesian (ABIC) information criteria between the current and the base-line models.

4.3 Estimation of the analytical model on levels 2 (student) and 3 (class)

The results of the two-level structural equation contextual effect analytical model on the student level 2 and class level 3 are reported in the sections below. **Table 16** gives an overview of the results.

Table 16

Results of the first analytical model in regard to student engagement on the student level 2 and class level 3 (standardized estimates, one-tailed p-values).

	Outcomes					
	State self-reported engagement			State on-task engagement		
Predictors	*Est.*	*p*	R^2	*Est.*	*p*	R^2
Student (level 2; n = 574)			0.80			0.37
Trait engagement	0.71	< 0.001		0.51	< 0.001	
State on-task engagement	0.30	< 0.001				
Gender (0 = boys, 1 = girls)	-0.08	< 0.001		0.22	< 0.001	
HISEI	-0.03	0.102		0.02	0.251	
Class (level 3; n = 34)			0.84			0.78
Trait engagement	1.66	0.031		1.02	< 0.001	
State on-task engagement	-0.58	0.132				
Gender (0 = boys, 1 = girls)	1.28	0.081		0.96	<0 .001	
HISEI	-0.23	0.188		-0.14	0.249	

The Satorra-Bentler scaled X^2 difference test (Asparouhov & Muthén; Cheung et al., 2021) proposed an adequate fit of the model to the data in comparison to the baseline model (Satorra-Bentler $X^2 = 808.67$, $\delta(df) = 14$, $p < 0.001$). The model fit statistics were: AIC = 6,448.22, BIC = 6,535.27, ABIC = 6,471.78 (baseline model fit statistics: AIC = 7,586.24, BIC = 7,612.36, ABIC = 7,593.31).

4.3.1 Results on the student level

On the student level, trait engagement significantly predicts state on-task engagement ($\beta = 0.51$, $p < 0.001$) and state self-reported engagement ($\beta = 0.71$, $p < 0.001$). Further, state on-task engagement itself also predicts state self-reported engagement ($\beta = 0.30$, $p < 0.001$).

In terms of the effect of gender and HISEI on student engagement, small significant effects of gender on state student engagement were found. In regard to state on-task engagement, girls are observed as more frequently engaged in a lesson than boys ($\beta = 0.22$, $p < 0.001$). Concerning state self-reported engagement, an opposing significant effect is found. Boys reported that they were more highly engaged in the lessons than girls did ($\beta = -0.08$, $p < 0.001$). No significant impact of HISEI on student engagement was found (both $p > 0.1$).

The R^2 values indicate that the predictor variables (trait engagement, state on-task engagement, gender, and HISEI) explain 80% of the variance in state self-reported engagement and 37% of the variance in state on-task engagement. Accordingly, trait engagement, in combination with gender and HISEI, is only able to explain about one-third of the variance in state on-task engagement. However, trait engagement and state on-task engagement, in combination with gender and HISEI, are able to explain more than two-thirds of the variance in state self-reported engagement.

4.3.2 Results on the class level

On the class level, aggregated trait engagement significantly predicts state on-task engagement ($\beta = 1.02$, $p < 0.001$) and state self-reported engagement ($\beta = 1.66$, $p = 0.031$). The effect of state on-task engagement itself on state self-reported engagement, however, is not found on the class level ($p > 0.1$).

In terms of the effect of gender and HISEI on class-aggregated student engagement, a significant effect of gender was only found for state on-task engagement ($\beta = 0.96$, $p < 0.001$). In

classes with a high proportion of girls, a higher aggregated state on-task engagement was observed than in classes with a high proportion of boys. Also on the class level, no significant impact of HISEI on student engagement was found (both $p > 0.1$).

The R^2 values indicate that the predictor variables (trait engagement, state on-task engagement, gender, and HISEI) explain 80% of the variance in state self-reported engagement and 78% of the variance in state on-task engagement. Accordingly, on the class level, both model parts are able to explain a similar amount of variance in engagement.

4.3.3 Results in regard to contextual effects

In regard to the investigation of the relationships between the three different types of student engagement on the student and the class level, it was of particular interest to examine whether there was a difference between the effects on the two levels concerning Hypothesis 4b.

Hypothesis 4b states that: There is a comparison referent effect related to class membership in regard to student engagement. Students with a similar state on-task engagement rate their self-reported engagement higher or lower than the class's average student engagement, in line with their perceptions of the class's engagement. This hypothesis can be statistically examined by observing the contextual effects (see **Table 17** and the discussion of the contextual effects below).

Table 17

Contextual effects of the first analytical model in regard to student engagement (unstandardized estimates, one-tailed p-values).

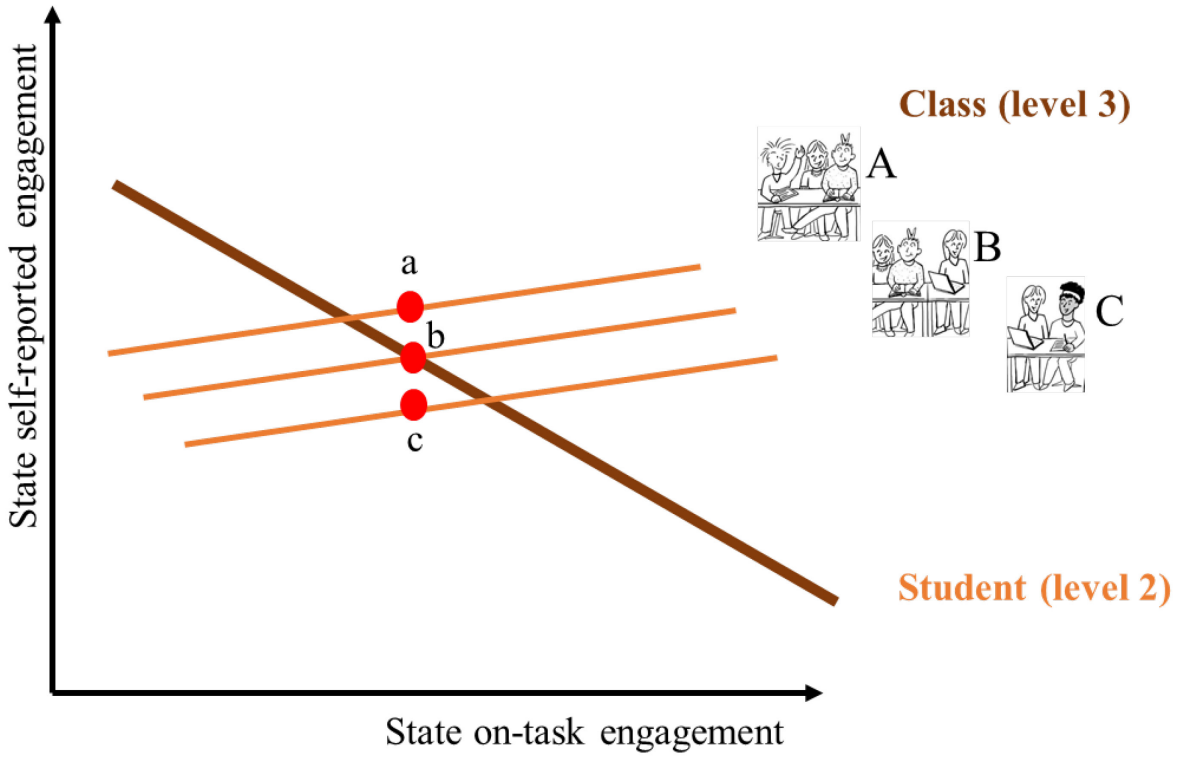
Contextual effect (Predictor → Outcome)	**Importance of the contextual effect**	
	Est.	*p*
Trait engagement → State self-reported engagement	-0.66	0.197
State on-task engagement → State self-reported engagement	-2.22	0.034
Gender → State self-reported engagement	2.66	0.059
HISEI → State self-reported engagement	-0.01	0.197
Trait engagement → State on-task engagement	0.21	0.034
Gender → State on-task engagement	0.78	0.008
HISEI → State on-task engagement	-0.00	0.239

There are three significant contextual effects found in regard to the investigation of student engagement through model A.

The first significant contextual effect concerns the effect of state on-task engagement on state self-reported engagement ($\beta = -2.22$, $p = 0.034$). The contextual effect estimate indicates that there is a significant positive effect on the student level, while there is a negative (insignificant) effect on the class level (see **Figure 11** for a visualization of the contextual effect). This means that students (e.g., student a in **Figure 11**) in classes with a lower average state on-task engagement (e.g., class A), generally indicate higher state self-reported engagement than students (e.g., student c) in classes with a higher average state on-task engagement (e.g., class C).

Figure 11

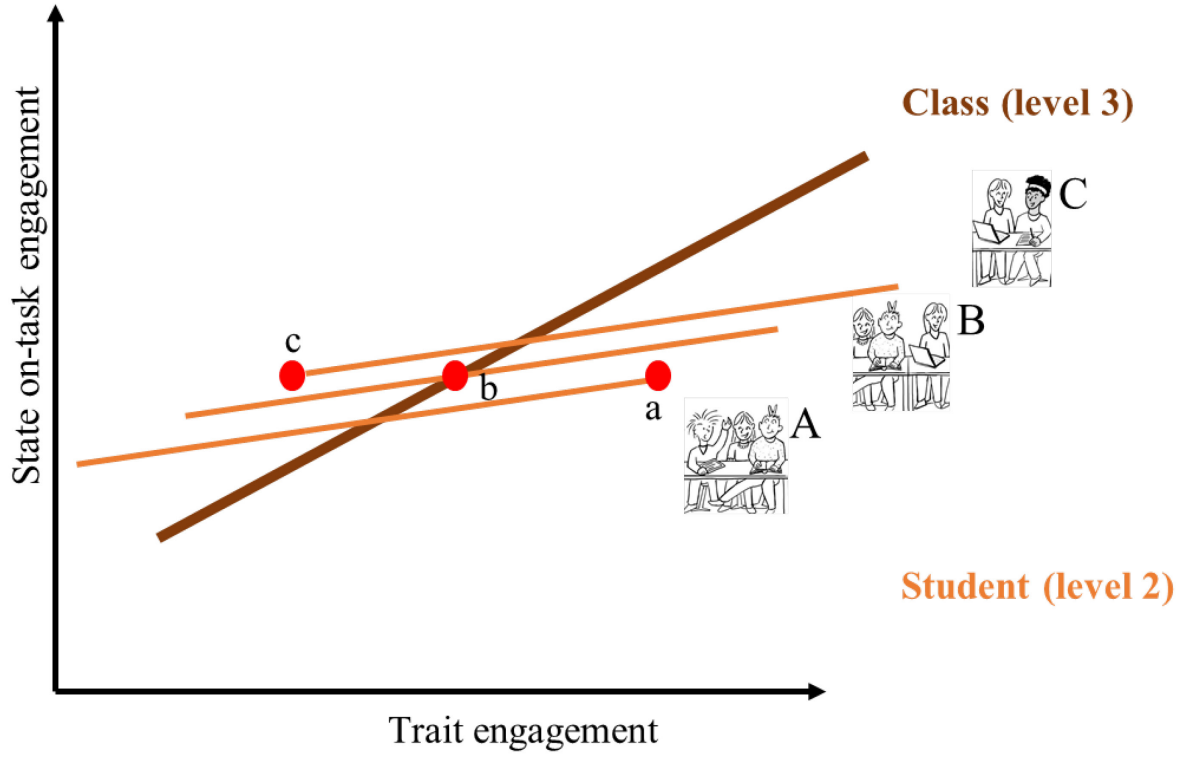
Exemplary visualization of the contextual effect in regard to the effect of state on-task engagement on state self-reported engagement.



The second significant contextual effect concerns the positive effect of trait engagement on state on-task engagement (β = 0.21, p = 0.034). The contextual effect estimate indicates that this effect is larger on the class level than it is on the student level. The effect is visualized in **Figure 12**. When looking at **Figure 12**, please be aware that in contrast to the earlier visualization in **Figure 11**, this time state on-task engagement is on the left-hand y-axis, as it is the outcome variable in this effect (and not the predictor variable as it was in the earlier effect). The context effect means that students (e.g., student a in **Figure 12**), in classes with a lower average state on-task engagement (e.g., class A), generally indicate higher trait engagement than students (e.g., student c) in classes with a higher average state on-task engagement (e.g., class C).

Figure 12

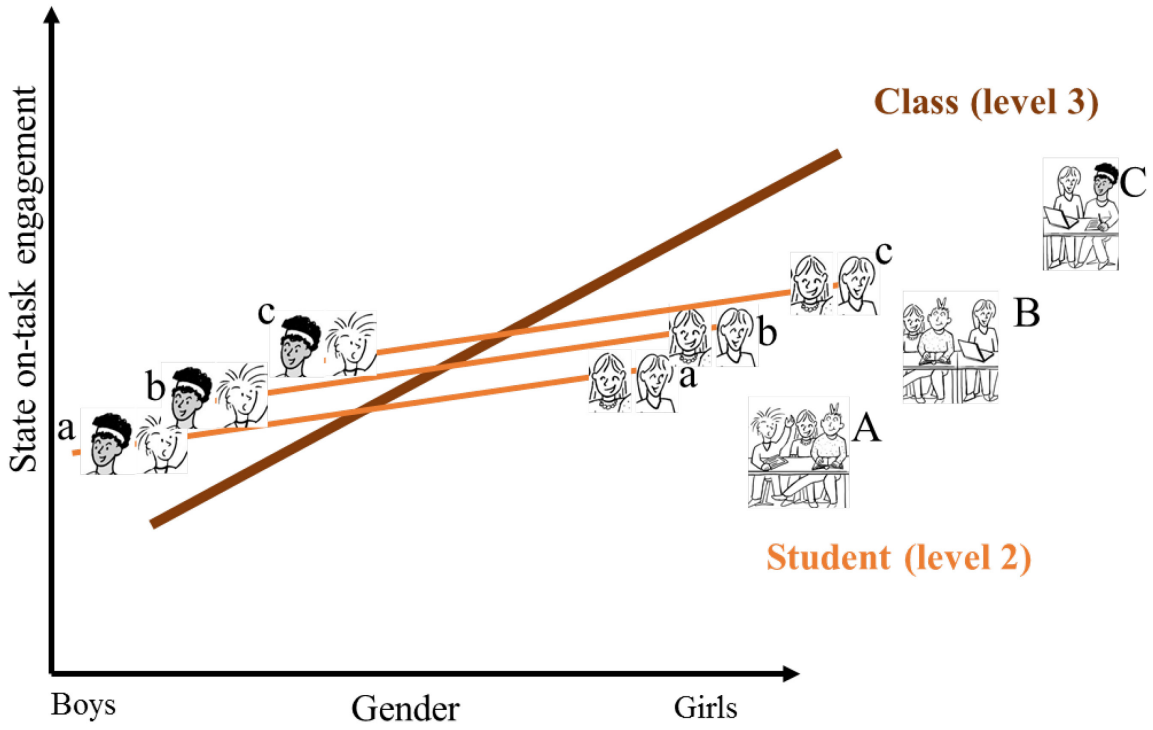
Exemplary visualization of the contextual effect in regard to the effect of trait engagement on state on-task engagement.



The third significant contextual effect concerns the positive effect of gender on state on-task engagement (β = 0.78, p = 0.008). The contextual effect estimate indicates that this effect is more important on the class level than it is on the student level. The effect is visualized in **Figure 13**. This means that generally the difference in state on-task engagement between students in classes with a high proportion of girls (e.g., student c in class C) and students in classes with a low proportion of girls (e.g., student a in class A) is more important than the difference in state on-task engagement between boys and girls in the same class. Accordingly, the gender balance of a class might be a better predictor of state on-task engagement than a student's gender.

Figure 13

Exemplary visualization of the contextual effect in regard to the effect of gender on state on-task engagement.



4.4 Estimations of the analytical model on levels 1 (lesson) and 2 (student)

The results of the second two-level structural equation contextual effect analytical model on the lesson level 1 and student level 2 are reported in the sections below. **Table 18** gives an overview of the results.

Table 18

Results of the second analytical model in regard to student engagement on the lesson level 1 and student level 2 (standardized estimates; one-tailed p-values for engagement types, gender, and HISEI; two-tailed p-values for teacher type, subjects, and social forms).

	Outcomes					
	State self-reported engagement			State on-task engagement		
Predictors	*Est.*	*p*	R^2	*Est.*	*p*	R^2
Lesson (level 1; n = 1,598)			0.27			0.03
Trait engagement	0.33	< 0.001		0.02	0.289	
State on-task engagement	0.29	< 0.001				
Teacher type (0 = subject teacher, 1 = class teacher)	-0.02	0.387		-0.04	0.272	
Subject A (0 = Arts & Crafts, 1 = English)	0.18	< 0.001		-0.01	0.805	
Subject B (0 = Arts & Crafts, 1 = German)	0.20	< 0.001		0.02	0.584	
Subject C (0 = Arts & Crafts, 1 = Social and Natural Sciences)	0.19	< 0.001		-0.12	0.001	
Pair work	0.07	0.021		0.10	0.001	
Group work	0.07	0.005		-0.11	< 0.001	
Plenum	0.07	0.005		0.01	0.620	
Individual work	0.04	0.332		0.07	0.104	
Student (level 2; n = 574)			0.78			0.36
Trait engagement	0.70	< 0.001		0.51	< 0.001	
State on-task engagement	0.30	< 0.001				
Gender (0 = boys, 1 = girls)	-0.05	0.008		0.23	< 0.001	
HISEI	-0.03	0.103		0.00	0.474	

The Satorra-Bentler scaled X^2 difference test (Asparouhov & Muthén; Cheung et al., 2021) proposed an adequate fit of the model to the data compared to the null model (Satorra-Bentler X^2 = 383.80, δ(df) = 26, p < 0.001).The model fit statistics were: AIC = 6,361.17, BIC =

6,543.97, ABIC = 6,435.96 (baseline model fit statistics: AIC = 7,977.13, BIC = 8,020.14, ABIC = 7,994.73).

4.4.1 Results on the lesson level

On the lesson level, trait engagement significantly predicts state self-reported engagement (β = 0.33, $p < 0.001$). However, trait engagement is not able to predict state on-task engagement on the lesson level ($p > 0.1$). Nevertheless, in this analysis state on-task engagement itself also predicts state self-reported engagement (β = 0.29, $p < 0.001$).

Teacher type (class teacher versus subject teacher) did not influence student engagement during the lesson (both $p > 0.1$). The subject and the social form, however, had an impact on student engagement. Students indicated that they were more engaged in English (β = 0.18, $p < 0.001$), German (β = 0.20, $p < 0.001$), and Social and Natural Sciences (β = 0.19, $p < 0.001$) than in Arts and Crafts. In regard to state on-task engagement, this effect, however, was not replicated. In regard to English and German, no significant difference from Arts and Crafts was found (both $p > 0.1$). Further, the observations indicated that students were less on-task engaged in the Social and Natural Sciences than in Arts and Crafts (β = -0.12, $p < 0.001$).

Students indicated that they were highly engaged in lessons with a high relative frequency of pair work (β = 0.07, $p = 0.021$), group work (β = 0.07, $p = 0.005$) and plenum (β = 0.07, $p = 0.005$). The relative frequency of individual work phases in lessons was not associated with state self-reported student engagement ($p > 0.1$). The state on-task engagement observation also found high student engagement in lessons with a high proportion of pair work (β = 0.10, $p = 0.001$). However, lessons with a high amount of group-work were negatively associated with on-task engagement (β = -0.11, $p < 0.001$). The proportions of plenum and individual work phases were not associated with state on-task engagement ($p > 0.1$).

The R^2 values indicate that the predictor variables explain 27% of the variance in state self-reported engagement and 3% of the variance in state on-task engagement. Accordingly, trait engagement is only able to explain a small amount of the variance in state on-task engagement. Nevertheless, trait engagement and state on-task engagement are able to explain about one-third of the variance in state self-reported engagement. The model section related to state self-reported engagement is, thus, able to explain more variance than the model section related to state on-task engagement on the student level.

4.4.2 Results on the student level

On the student level, the results from the first analytical model are replicated. Trait engagement significantly predicts state on-task engagement ($\beta = 0.70$, $p < 0.001$) and state self-reported engagement ($\beta = 0.30$, $p < 0.001$). An effect of state on-task engagement itself on state self-reported engagement was also found ($\beta = 0.51$, $p < 0.001$).

Further, small significant effects of gender on state student engagement were found. In regard to state on-task engagement, girls are observed as more frequently engaged in a lesson than boys ($\beta = 0.23$, $p < 0.001$). Concerning state self-reported engagement, an opposing significant effect was found. Boys reported that they were more highly engaged in the lessons than girls did ($\beta = -0.05$, $p = 0.008$). No significant impact of HISEI on student engagement was found (both $p > 0.1$).

The R^2 values indicate that the predictor variables explain 78% of the variance in state self-reported engagement and 36% of the variance in state on-task engagement. Accordingly, trait engagement, in combination with gender and HISEI, is only able to explain about one-third of the variance in state on-task engagement. However, trait engagement and state on-task engagement, in combination with gender and HISEI, are able to explain more than two-thirds of the

variance in state self-reported engagement. The model section related to state self-reported engagement is, thus, able to explain more than double the variance that the model section related to state on-task engagement on the student level can.

4.5 Discussion concerning research question one

Research question one investigated how the measures of student engagement in class relate to one another. As mentioned in section 2, prior work has documented the importance of student engagement for student achievement (Finn et al., 1995; Hattie & Anderman, 2013; Lundervold et al., 2017). Nevertheless, in the context of educational psychology there are different types of conceptualizations in regard to student engagement (Ainley, 2012). Further, only a few studies have investigated student engagement with younger students in elementary schools (see literature review in section 2.2). Additionally, there are only a few empirical investigations that compare different types of measurements of student engagement (Knogler & Böheim, 2019). The present dissertation tries to tackle this gap with research question one by triangulating three student level engagement measures varying, firstly, in terms of their amounts of procedural versus substantive engagement, and secondly, in regard to their stability (state versus trait-relatedness; see **Table 15**). Additionally, an investigation was conducted into how class membership, gender, teacher type and the social form of the lesson might affect student engagement.

4.5.1 Triangulation of student engagement in class

The findings confirm both hypothesis 1a, which proposed that other-person-assessed measurements of student engagement positively predict self-reported measurements of student engagement during class, and hypothesis 1b, which proposed that prior measurements of trait student engagement positively predict later measurements of state student engagement in class. The measurement of trait student engagement, nevertheless, in line with hypothesis 1c, predicts

about twice as much variance as the measurement of state on-task engagement does, in regard to state self-reported engagement. This indicates that the different types of student engagement during class might capture the same construct of student engagement during class from different perspectives. This difference in the amount of variance explained might be attributable to the different parts of student engagement in class that are considered by the different types of student engagement. While trait engagement and state self-reported engagement take substantial and procedural engagement into account, state on-task engagement mainly focusses on procedural engagement (as substantial engagement is only partially observable; Spanjers et al., 2008). Accordingly, it is important to take underlying assumptions of a measurement into account when investigating student engagement in class, as the different types of measurement might be looking at the same construct from different perspectives, resulting in slightly different measures (Knogler & Böheim, 2019; Martins et al., 2022; Sinatra et al., 2015; Skinner et al., 2009; Spanjers et al., 2008).

4.5.2 Impact of class composition on student engagement

In line with the theory of social comparison processes developed by Festinger (1954), who proposed that individuals judge their own behavior through a comparison of themselves with similar people in their social environment, the results show a comparison referent effect in regard to classmates, confirming hypothesis 4b. Students with the same state on-task engagement who are members of a class with a high average state on-task engagement, estimate that they exhibit lower trait and state self-reported engagement than students in a class with low average state on-task engagement. Accordingly, it can be assumed that students compare themselves to their classmates in order to gain an understanding of themselves and to build a self-assessment of their own engagement during class.

Accordingly, students might compare themselves with their classmates in order to make a judgment on their own engagement behavior in class. Consequently, the classmates' engagement behavior serves students as a comparative standard and as a guide to what constitutes low, normal, and/or high engagement during class. This interpretation is reminiscent of the well-known 'big-fish-little-pond effect' (Marsh & Parker, 1984). The 'big-fish-little-pond effect' states that "equally able students have lower academic self-concepts in schools or classes where the average achievement level is high than in schools or classes where the average achievement level is low" (Dijkstra et al., 2008, p. 587). While the 'big-fish-little-pond effect' concerns student achievement and academic self-concept, it is plausible to assume that students also use their classmates as a comparative standard in regard to engagement during class. Accordingly, it seems that students in highly engaged classes underestimate their own engagement, while students in less engaged classes overestimate their own engagement during class.

4.5.3 Impact of gender and socio-economic status on student engagement

Regarding the socio-economic status of the students, contrary to hypothesis 3b, no effect was found in the analysis. Accordingly, the present dissertation did not replicate the findings of earlier studies in regard to the impact of socio-economic status on student engagement.

Several gender effects in regard to student engagement were found. In regard to state self-reported engagement, boys generally indicated higher engagement than girls. This is contrary to hypothesis 3a. Concerning state on-task engagement, however, the opposite was found: In the observations, girls generally showed more engagement during class than boys. This latter finding in regard to state on-task engagement replicates previous findings (Appel, 2015; Godwin et al., 2016) and is in line with hypothesis 3a.

In the light of both findings in regard to gender mentioned above, it could be inferred that boys overestimate and girls underestimate their engagement during class. This finding would be in

line with the results of research that has shown that generally the self-concept of boys is more positive than that of girls. This might lead to an overestimation of their own capabilities (Preckel et al., 2008; Skaalvik & Skaalvik, 2004).

Another alternative explanation for the findings could lie in gender-related social norms regarding student engagement. Research shows that there might be different behavioral expectations from teachers and from society towards girls and boys that are mirrored in the respective gender stereotypes (Heyder et al., 2021; Jones & Myhill, 2004). Teacher expectations have been shown to have an important impact on students' academic engagement (Tyler & Boelter, 2008).

The additional context effect of the class that was found in regard to state on-task engagement indicates that the impact of the proportion of female students in a class on aggregated student engagement is more important than a student's own gender in predicting student engagement. This effect is congruent with earlier findings in regard to student engagement, which have indicated that class composition might be more important than students' gender in the prediction of student engagement (Appel, 2015).

4.5.4 Impact of the subject, the social form, and the teacher on student engagement

On the lesson level, results show, contrary to the hypothesis 5b, no impact of teacher type on student engagement during class. This could potentially be due to only differentiating in terms of main class teacher versus subject teacher, but not in terms of how many lessons a teacher teaches a class on a regular basis. Accordingly, while this distinction might capture the responsibility of class teachers for their classes, it might not be able to capture the relationship students have with a teacher. This might be more important for student engagement.

In accordance with hypothesis 6a, the subject affects student engagement in class. The impact of the subject on student engagement, however, differs depending on the measurement of student engagement in focus. In terms of state self-reported engagement, students indicated that

they were more engaged during lessons in English, German, and Social and Natural Sciences than during lessons in Arts and Crafts. This finding, however, was not replicated by the state on-task engagement measurement. In regard to the state on-task engagement measurement, students were observed to be more engaged during lessons in Arts and Crafts than during lessons in Social and Natural Sciences. No differences in state on-task engagement between lessons in Arts and Crafts and lessons in German and/or English were found. An explanation of the differences found between the two measurements might lie in the social perception of different subjects. This could possibly directly affect ratings in the self-reported engagement measurement, but not necessarily as strongly the observer ratings in the on-task engagement measurement.

The social form, in accordance with hypothesis 6b, shows small effects on student engagement in class. The results indicate that the relative amount of pair work, group work and work in the plenum positively predict state self-reported engagement. The relative amount of individual work does not have an impact on state self-reported engagement or on state on-task engagement. Further, the positive effect of the relative amount of pair work is replicated for state on-task engagement, while the relative amount of group work has a negative effect on state on-task engagement, and the relative amount of work in the plenum does not affect state on-task engagement. As these effects are all very small, it is difficult to attribute the difference between the two state engagement measures clearly.

5 Research question two: Motivation, self-control, and student engagement

With research question two the relationships between motivation, self-control and state student engagement during class were investigated. More specifically, an examination was made of, firstly, how self-control and different types of student motivation affect student engagement during class and, secondly, whether self-control might moderate the effects of the different types of motivation on student engagement in class. This investigation was conducted separately for state self-reported engagement and for state on-task engagement during class.

5.1 Hypotheses investigated with research question two

Research question two investigated how motivation and self-control are associated with student engagement during class. The following hypotheses are associated with this research question.

Hypothesis 2a: Self-control positively predicts student engagement.

Hypothesis 2b: Intrinsic motivation positively predicts student engagement in class.

Hypothesis 2c: Self-control moderates the relationship between (intrinsic and/or extrinsic) motivation and engagement. The higher the self-control, the stronger the relationship between motivation and student engagement.

Hypothesis 4a: Subjectively perceived, descriptive class-engagement norms positively predict student engagement.

Hypothesis 5a: Teacher and/or parent-related extrinsic motivation positively predict student engagement.

All hypotheses allow clear predictions to be made of the effects, and accordingly are tested with one-sided *p*-values.

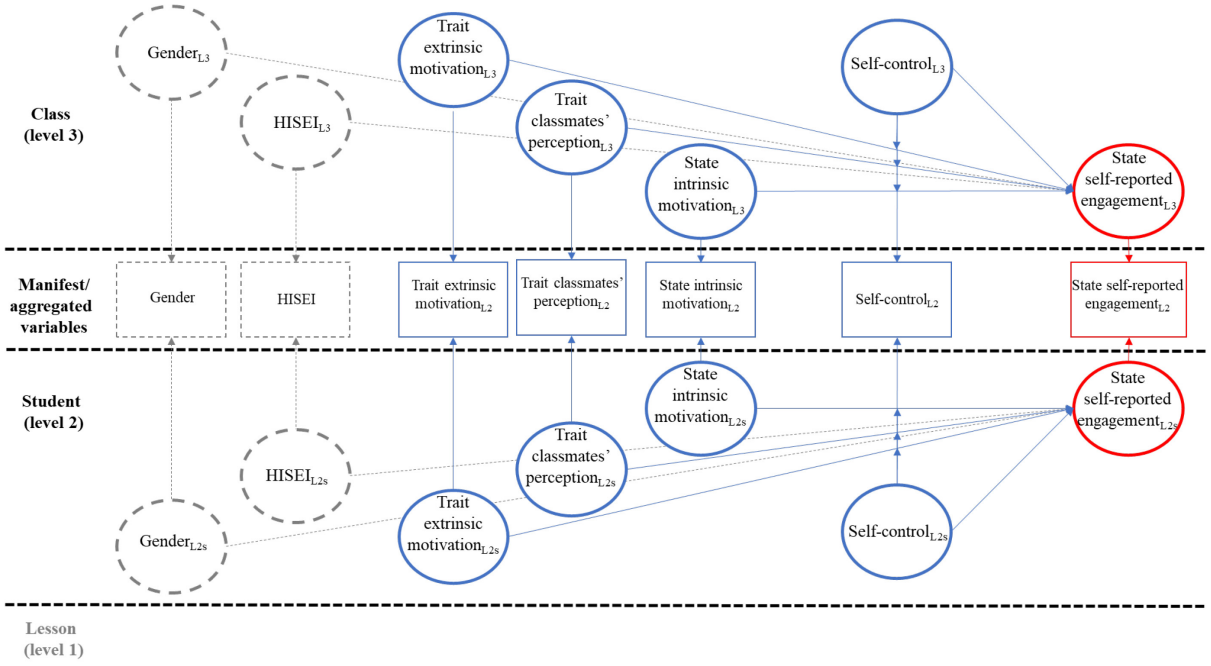
5.2 Analytical strategy for research question two

The analysis in regard to research question two was conducted with two two-level structural equation moderation models on level 2 (students) and level 3 (class; see **Figure 14**). The model estimation was conducted separately for the two types of state engagement (self-reported and on-task). With these analytical models, the impact of different types of motivations on student engagement, and a possible moderating effect of motivation and self-control on engagement were investigated. A moderating effect in this case can be understood in the way that the effect of motivation on engagement differs depending on the amount of self-control a student possesses. As there were clear predictions of the effects postulated, one-sided *p*-values were chosen for the analyses.

Three motivation measures were included in the models: trait adult-related extrinsic motivation, trait subjective class-engagement norms, and state intrinsic motivation. For intrinsic motivation, the state measure was used in the analytical models, because the present low ICC value (for trait intrinsic motivation 0.16; for state intrinsic motivation between 0.19 and 0.23; see **Table 14**), in line with those in the literature (Götz et al., 2014), indicate that intrinsic motivation might be susceptible to situational circumstances (for example the topic discussed in a lesson). Thus, these values might be better predictors of state engagement than of trait engagement. For extrinsic motivation, the present ICC values are comparatively high (values between 0.59 and 0.72; see **Table 14**). Accordingly, it can be assumed that there is less divergence in extrinsic motivation between subjects. In addition to the motivation and engagement measures, gender and SES were included in the analytical models as control variables.

Figure 14

Hypothesized two-level structural equation model of motivation and state self-reported engagement.



The moderation analyses were conducted as proposed by Cheung et al. (2021) to test complex structural models: First, the moderation model was computed once without the moderation term and a second time including the moderation term. Then, the fit of the two models was compared using a Satorra-Bentler scaled X^2 difference test (Satorra & Bentler, 2010), to determine whether including the moderation term improves the model fit. If including the moderation term would not improve model fit, the moderation is considered non-significant.

In addition to the Satorra-Bentler scaled X^2 difference test, the Akaike (AIC), the Bayesian (BIC), and the Adjusted Bayesian (ABIC) comparisons of information criteria were used to investigate the model fit between the current and the baseline model. While both approaches to investigate model fit (X^2 difference test versus comparison of information criteria) are frequently used, they might differ in their recommendations, as they rely on slightly different statistical assumptions. In accordance with Cheung et al. (2021, p. 1021), the model fit assessment

using the Satorra-Bentler scaled X^2 difference test is given priority over the comparison of information criteria in cases of incongruity between the conclusions provided by the two approaches. Several authors (e.g., Cheung et al., 2021; Klein & Moosbrugger, 2000; Muthén, 2012) recommend using the X^2 difference test (rather than the assessment with the information criteria) in regard to the comparison of the model fit of nested models, as the X^2 difference test is better suited to comparing nested models, as is the case in the present analysis.

5.3 Model estimation for state self-reported engagement

In **Table 19**, an overview of the results from the model including the moderations between different types of motivation and self-control is displayed.

The model comparison with the Satorra-Bentler scaled X^2 difference test (Asparouhov & Muthén; Cheung et al., 2021) in regard to the estimation of state self-reported engagement indicated that, as expected, the model including moderations was better fitted to the data (Satorra-Bentler $X^2 = 45.84$, $\delta(df) = 6$, $p < 0.001$). The model fit parameters of the moderation model statistics were AIC = 12,375.95, BIC = 12,467.36, ABIC = 12,400.69 (for the model without moderation, the model fit statistics were: AIC = 9,963.95, BIC = 10,029.24, ABIC = 9,981.62). Accordingly, while the X^2 difference test showed a preference for the model including moderations, the AIC, BIC and ABIC statistics are preferable for the model without moderations. In accordance with the discussion on the model fit assessment in section 5.2, the conclusion of the Satorra-Bentler scaled X^2 difference test is given priority.

Table 19

Results from the model of the influences of motivation and self-control on state self-reported engagement (standardized estimates, one-tailed p-values).

	Outcome state self-reported engagement		
Predictor	*Est.*	*p*	R^2
Student (level 2; n = 574)			0.83
Trait extrinsic motivation	-0.18	< 0.001	
Trait classmates' perception	0.01	0.334	
State intrinsic motivation	0.40	< 0.001	
Self-control	0.64	< 0.001	
Trait extrinsic motivation * Self-control	0.03	0.092	
Trait classmates' perception * Self-control	0.01	0.370	
State intrinsic motivation * Self-control	-0.06	0.001	
Gender (1 = girls, 0 = boys)	0.00	0.432	
HISEI	-0.02	0.092	
Class (level 2; n = 34)			0.99
Trait extrinsic motivation	0.06	0.382	
Trait classmates' perception	0.43	0.099	
State intrinsic motivation	0.52	0.012	
Self-control	0.54	0.010	
Trait extrinsic motivation * Self-control	-0.04	0.387	
Trait classmates' perception * Self-control	-0.32	0.127	
State intrinsic motivation * Self-control	-0.05	0.390	
Gender (1 = girls, 0 = boys)	-0.27	0.088	
HISEI	0.17	0.159	

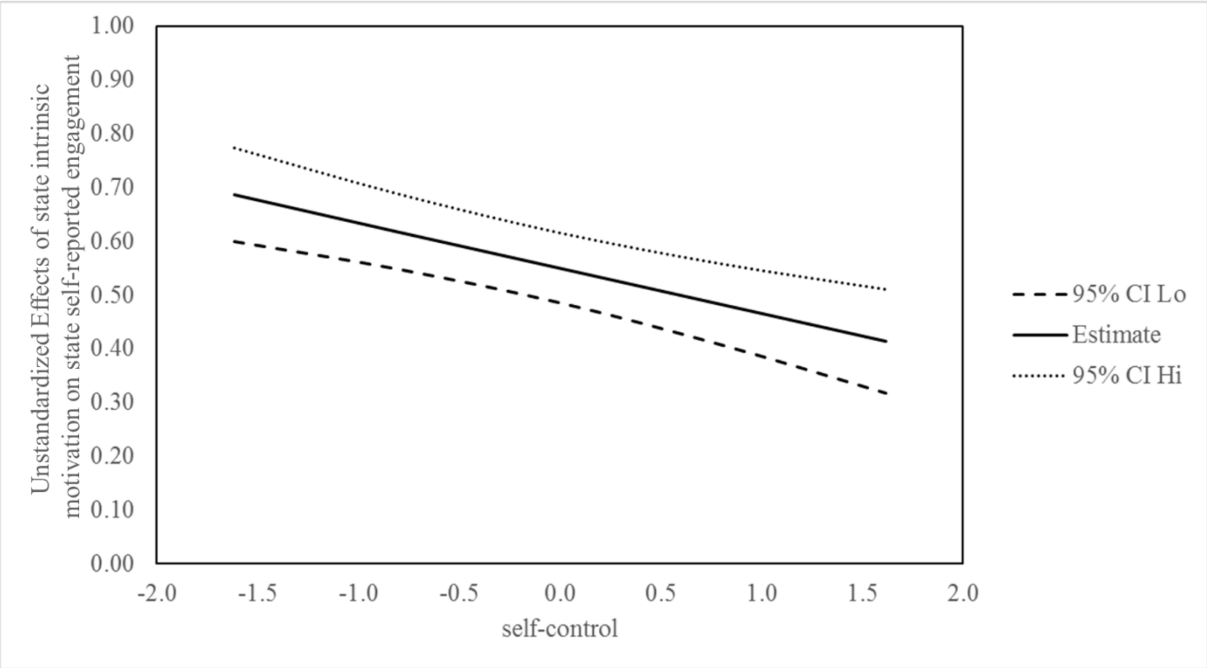
5.3.1 Results on the student level

Trait extrinsic motivation negatively predicts state self-reported engagement (β = -0.18, p < 0.001), while trait classmates' perception (p > 0.1) does not predict engagement. State intrinsic motivation (β = 0.40, p < 0.001) and self-control (β = 0.64, p < 0.001) positively predict state self-reported engagement. Neither gender (p > 0.1) nor HISEI (p > 0.05) predicts engagement

on the student level. A significant moderation of motivation and self-control is only found for state intrinsic motivation (β = -0.06, p = 0.001; other types of motivation: p > 0.05). The effect of the moderation is visualized in the Johnson-Neyman plot in **Figure 15**. The moderation effect indicates that for students with low self-control, the impact of state intrinsic motivation on state self-reported engagement is higher than for students with high self-control.

Figure 15

Johnson-Neyman plot of the moderation effect of self-control on the influence of state intrinsic motivation on state self-reported engagement.



The R^2 value indicates that the predictor variables explain 83% of the variance in state self-reported engagement on the student level (see **Table 19**).

5.3.2 Results on the class level

On the class level, trait extrinsic motivation (p > 0.1) and trait classmates' perception (p > 0.05) do not predict state self-reported engagement. State intrinsic motivation (β = 0.52, p = 0.012) and self-control (β = 0.54, p = 0.010) positively predict state self-reported engagement. Neither

gender ($p > 0.05$) nor HISEI ($p > 0.1$) predicts engagement on the class level. No significant moderation of motivation and self-control was found on the class level (all $p > 0.1$).

The R^2 value indicates that the predictor variables explain 99% of the variance in state self-reported engagement on the class level (see **Table 19**).

5.4 Model estimation for state on-task engagement

In **Table 20**, an overview of the results from the model including the moderations between different types of motivation and self-control is displayed.

The model comparison with the Satorra-Bentler scaled X^2 difference test (Asparouhov & Muthén; Cheung et al., 2021) in regard to the estimation of state on-task engagement indicated that the model including moderations, as expected, was better fitted to the data (Satorra-Bentler $X^2 = 45.98$, $\delta(df) = 6$, $p < 0.001$). The model fit of the moderation model statistics of the model were AIC = 11,622.63, BIC = 11,714.03, ABIC = 11,647.37 (for the model without moderation, the model fit statistics were: AIC = 9,203.92, BIC = 9,269.21, ABIC = 9,221.59). Accordingly, while the X^2 difference test showed a preference for the model including moderations, the AIC, BIC and ABIC statistics are preferable for the model without moderations. In accordance with the discussion on the model fit assessment in section 5.2, the conclusion of the Satorra-Bentler scaled X^2 difference test is given priority.

Table 20

Results from the model of the influences of motivation and self-control on state on-task engagement (standardized estimates, one-tailed p-values).

	Outcome state on-task engagement		
Predictor	*Est.*	*p*	R^2
Student (level 2; n = 574)			0.63
Trait extrinsic motivation	-0.11	< 0.001	
Trait classmates' perception	0.34	< 0.001	
State intrinsic motivation	0.19	< 0.001	
Self-control	0.43	< 0.001	
Trait extrinsic motivation * Self-control	-0.02	0.277	
Trait classmates' perception * Self-control	0.04	0.170	
State intrinsic motivation * Self-control	0.05	0.025	
Gender (1 = girls, 0 = boys)	0.14	< 0.001	
HISEI	-0.01	0.356	
Class (level 2; n = 34)			0.96
Trait extrinsic motivation	-0.19	0.387	
Trait classmates' perception	-0.37	0.387	
State intrinsic motivation	0.32	0.376	
Self-control	1.11	0.049	
Trait extrinsic motivation * Self-control	0.27	0.302	
Trait classmates' perception * Self-control	0.68	0.268	
State intrinsic motivation * Self-control	0.24	0.340	
Gender (1 = girls, 0 = boys)	-0.08	0.456	
HISEI	0.41	0.134	

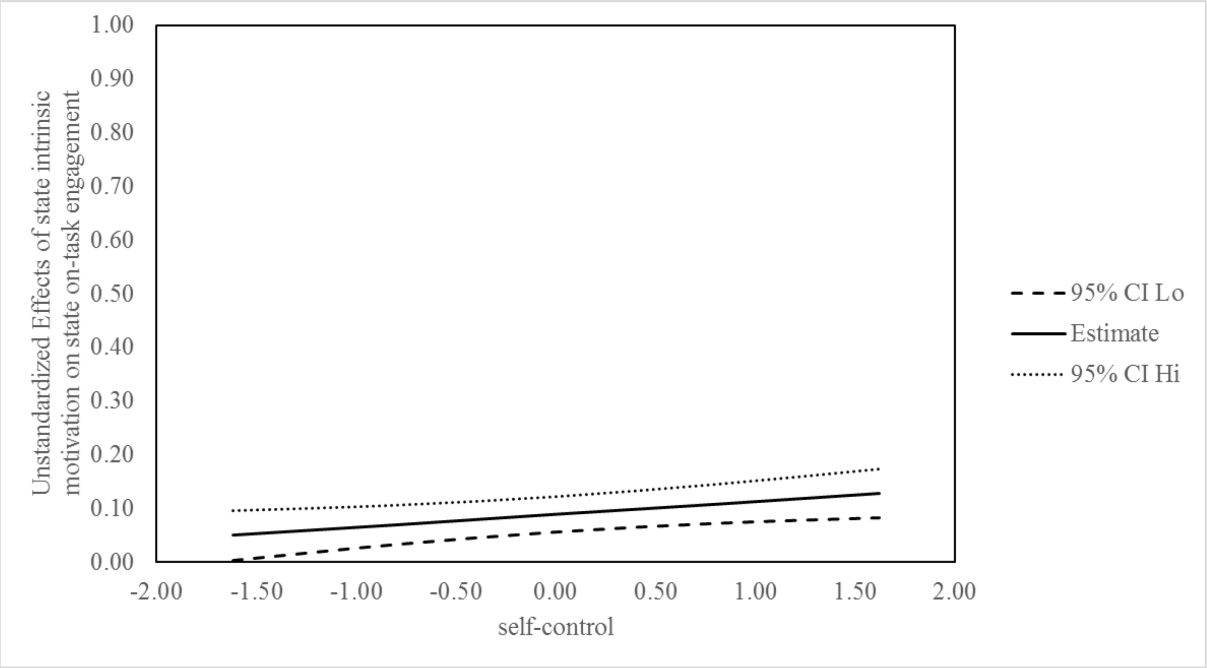
5.4.1 Results on the student level

Trait extrinsic motivation negatively predicts state on-task engagement (β = -0.11, $p < 0.001$), while trait classmates' perception (β = 0.34, $p < 0.001$), state intrinsic motivation (β = 0.19, $p < 0.001$) and self-control (β = 0.43, $p < 0.001$) positively predict state on-task engagement. Gender (β = 0.14, $p < 0.001$) positively predicts engagement, while there is no effect of HISEI

($p > 0.05$) on engagement on the student level. A significant moderation of motivation and self-control was only found for state intrinsic motivation ($\beta = 0.05$, $p = 0.025$; other types of motivation: $p > 0.1$). The effect of the moderation is visualized in the Johnson-Neyman plot in **Figure 16**. The moderation effect indicates that for students with higher self-control, the impact of state intrinsic motivation on state self-reported engagement is higher than for students with low self-control.

Figure 16

Johnson-Neyman plot of the moderation effect of self-control on the influence of state intrinsic motivation on state on-task engagement.



The R^2 value indicates that the predictor variables explain 65% of the variance in state on-task engagement on the student level (see **Table 20**).

5.4.2 Results on the class level

On the class level, trait extrinsic motivation, trait classmates' perception, and state intrinsic motivation (all $p > 0.1$) do not predict state on-task engagement. Self-control, however, positively predicts state self-reported engagement ($\beta = 1.11$, $p = 0.049$). Neither gender nor HISEI (both $p > 0.1$) predicts engagement on the class level. No significant moderation of motivation and self-control was found on the class level (all $p > 0.1$).

The R^2 value indicates that the predictor variables explain 96% of the variance in state self-reported engagement on the class level (see **Table 20**).

5.5 Discussion concerning research question two

A lack of research on factors affecting student engagement in elementary school using observational measurements was detected by prior work (Godwin et al., 2016) and by a structured literature review (see section 2.2). Research question two tries to tackle this research gap by investigating, firstly, how self-control and different types of motivation affect student engagement during class and, secondly, whether and how self-control might moderate the effects of the different types of motivation on student engagement in class.

5.5.1 Influence of self-control on student engagement

In line with hypothesis 2a, results in regard to state self-reported engagement and state on-task engagement indicate that students' self-control positively impacts students' engagement during class. The higher students rate their self-control in the trait questionnaire, the higher are the self and the observer ratings of their engagement during class. This is in line with results from prior work indicating that self-control positively affects engagement (Blair & Razza, 2007; Cappella et al., 2013; Rimm-Kaufman et al., 2009; Smith-Donald et al., 2007; Zhao et al., 2019).

The results indicate that the positive effect of self-control on student engagement during class is relevant not only when looking at individual students, but also when looking at the whole class. Classes with higher average self-control show higher average engagement than classes with lower average self-control.

5.5.2 Influence of extrinsic motivation on student engagement

In the present dissertation two types of extrinsic motivation affecting student engagement during class were investigated. On the one hand, teacher and/or parent-related extrinsic motivation was examined, and, on the other hand, subjectively perceived classroom descriptive social norms, relating to the perceived engagement of classmates in terms of trait classmates' perception was investigated.

Teacher and/or parent-related extrinsic motivation, contrary to hypothesis 5a, was negatively associated with student state self-reported engagement and on-task engagement. Accordingly, the more important it is for students to receive praise and/or to avoid reprimands, the lower their engagement in class is rated. This finding is in line with the 'overjustification' effect, indicating that extrinsic reinforcement of a behavior might diminish a child's intrinsic motivation to act upon the behavior (Bem, 1972; Greene et al., 1976).

Concerning subjectively perceived classroom descriptive social norms, the hypothesized positive effect mentioned in hypothesis 4a was only found in regard to state on-task engagement but not in regard to state self-reported engagement. Students perceiving high engagement in their classmates were observed as engaging more during class than students perceiving low engagement in their classmates. This effect is congruent with the proposition that descriptive social norms in the classroom might influence student behavior (e.g., Dishion & Tipsord, 2011; Hartup, 2009; Müller & Zurbriggen, 2016).

5.5.3 Influence of intrinsic motivation on student engagement

Congruent with results from prior work (Ainley et al., 2005; Ainley, Hidi, et al., 2002; Ainley, Hillman, et al., 2002) and hypothesis 2b, intrinsic motivation positively predicts student engagement in class. Student engagement is higher for students who enjoy the lesson and are interested in the content of a lesson.

The results indicate that the positive effect of intrinsic motivation on student state self-reported engagement during class is relevant not only when looking at individual students, but also when looking at the whole class. Classes with higher overall intrinsic motivation show higher overall state self-reported engagement than classes with lower intrinsic motivation. This effect, however, was only found for state self-reported engagement and not for state on-task engagement. A possible explanation, congruent with the discussion of the different observability of student engagement (e.g.. Götz et al., 2014; Knogler & Böheim, 2019; Skinner et al., 2009; Spanjers et al., 2008), could be that state motivation is more closely related to state self-reported engagement, as both are self-reported measurements related to the same instrument. In contrast, state on-task engagement is measured from an observer's perspective.

5.5.4 Interaction of self-control and motivation on student engagement

Interaction effects of self-control and motivation were only found for intrinsic motivation. The effects found in regard to the two state engagement measures are both very small and point in the opposite direction. Accordingly, it is questionable whether this effect could be reproduced in further studies or not, and, therefore, whether the effect is really important or not.

Concerning the measurement of state self-reported engagement, a very small negative moderation effect was found. This indicates that the lower a student's self-control is, the higher the impact of intrinsic motivation on state self-reported engagement is.

Concerning the measurement of state on-task engagement, a very small positive moderation effect was found, indicating that the impact of intrinsic motivation on state on-task engagement is higher, the greater a student's self-control is.

Because the effects are incongruent for the two measurements of state student engagement, this interaction should be further investigated carefully and it seems to be questionable whether there is a moderation effect of self-control on the relationship between intrinsic motivation and student engagement in class. Therefore, hypothesis 2c cannot be confirmed. Nevertheless, in line with the propositions of prior work, it can be assumed that self-control and different types of motivation might have an important impact on student engagement in class (Appleton et al., 2006).

6 Research question three: Motivation, engagement and class networks

Research question three investigated student state engagement and state intrinsic motivation in regard to friendships and negative relationships in a class.

6.1 Hypotheses investigated by question three

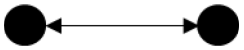
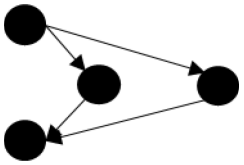
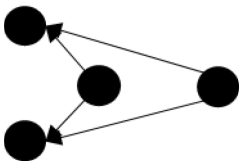
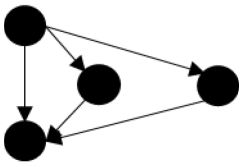
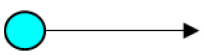
Research question three examines how student motivation and engagement are associated with the social network in class. **Table 21** gives an overview of the statistical hypotheses and the corresponding configurations.

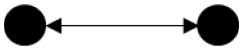
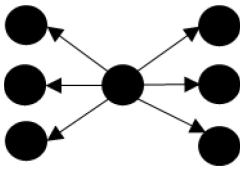
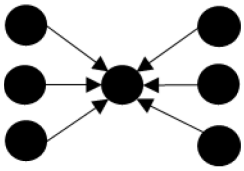
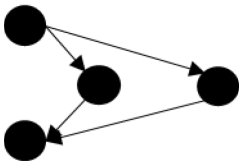
Note, as discussed in section 6.2.1, in social networks there are some general configurations related to the general structure of social relations usually occurring in a classroom. These general social network configurations also need to be taken into account for the modelling. Such configurations are labelled with the abbreviation GSNC (general social network configuration) in **Table 21**. There are also two further constellations included in the model (FC) that are not directly related to hypotheses investigated in this dissertation.

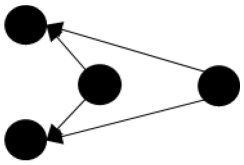
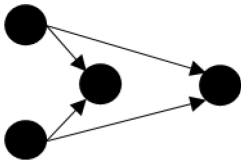
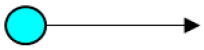
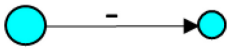
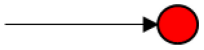
All hypotheses allow for clear prediction of the related effects. Accordingly, one-sided *p*-values were chosen for hypothesis testing.

Table 21

Hypothesized configurations included in the social network analysis in regard to the interdependencies between student relationships in class, student state intrinsic motivation and engagement during class.

Network	Hypothesis	Interpretation/ Statistical hypothesis behind the configuration	Illustration of the configuration	Name of the configuration
Friendship-Network	GSNC	If a student nominates a classmate as his/her friend, the classmate is likely to nominate the student back as a friend.		Reciprocity
	GSNC	It is unlikely that the same path of friendship nominations occurs multiple times in a classroom (negative estimate: few multiple two-paths are expected).		Multiple two-paths (A2P-T)
	GSNC	It is unlikely that the same combination of student friendship nominations occurs frequently in a class (negative estimate: few shared in-ties are expected).		Shared in-ties (A2P-D)
	GSNC	It is likely that friends of friends of a student are befriended with one another in a class (building friendship groups/ clusters).		Transitive closure (AT-T)
	GSNC	Students are more likely to nominate classmates of the same gender as friends (negative estimate expected: little gender difference with befriended classmates expected).		Gender - Difference
	FC	Students with high intrinsic motivation are more likely to accept classmates. → Students with high intrinsic motivation are more likely to send out friendship nominations.		Motivation - Sender

Network	Hypothesis	Interpretation/ Statistical hypothesis behind the configuration	Illustration of the configuration	Name of the configuration
Friendship-Network	GSNC	Students with a similar level of intrinsic motivation are more likely to be friends. → Students are more likely to send out friendship nominations to students with a similar level of intrinsic motivation (negative estimate: little difference in motivation is expected).		Motivation - Difference
	4c	Students with high engagement are more likely to be accepted by classmates. → Students with high engagement are more likely to receive friendship nominations.		Engagement - Receiver
Negative relationships-Network	GSNC	If a student dislikes sitting next to a classmate, the classmate is likely also to dislike sitting next to the student.		Reciprocity
	GSNC	It is likely that students generally send out many dislike seating nominations.		Out-ties spread (A-out-S)
	GSNC	It is unlikely that students generally receive many dislike seating nominations (negative estimate: few in-ties are expected).		In-ties spread (A-in-S)
	GSNC	It is unlikely that the same path of disliked seatmate nominations occurs multiple times in a classroom (negative estimate: a low number of multiple two-paths is expected).		Multiple two-paths (A2P-T)

Network	Hypothesis	Interpretation/ Statistical hypothesis behind the configuration	Illustration of the configuration	Name of the configuration
Negative relationships-Network	GSNC	It is unlikely that the same combination of student disliked seatmate nominations occurs frequently in a class (negative estimate: a low number of shared in-ties is expected).		Shared in-ties (A2P-D)
	GSNC	It is likely that students are nominated as disliked seatmates that have been already nominated by other classmates.		Shared out-ties (A2P-U)
	GSNC	Students are less likely to nominate classmates of the same gender as disliked seatmates.		Gender - Difference
	FC	Students with high intrinsic motivation are less likely to reject classmates. →Students with high intrinsic motivation are less likely to send out disliked seatmate nominations (negative estimate: negative association between the level of motivation and the number of disliked seatmate nominations expected).		Motivation - Sender
	4h	Students with a different level of intrinsic motivation are more likely to be rejected. → Students with a different level of intrinsic motivation are more likely to be nominated as disliked seatmates.		Motivation - Difference
	4d	Students with low engagement are more likely to be rejected by classmates. → Students with low engagement are more likely to receive disliked seatmate nominations (negative estimate: negative association between the level of engagement and the number of disliked seatmate nominations expected).		Engagement - Receiver

Note: for certain configurations, a negative estimate of the configuration (unlikeliness) is hypothesized.

6.2 Social network analysis approach for research question three

Research question three investigates how student motivation and engagement are associated with the relationship structure in class. In order to consider the social relationship structure in class, a social network analysis approach was chosen (as stated in section 3.5). Social network analysis is a research method used to examine the structure of social relationships and interactions between individuals (social networks; Borgatti et al., 2009). Social network analysis originated in the beginning of the twentieth century in the social sciences and is currently gaining popularity in the educational sciences (Mejeh & Hascher, 2021).

In the present research, social networks are understood as the relationship structure amongst students in a class. More specifically, the present class social networks are conceptualized by investigating friendship relationships and negative relationships amongst the students. In comparison to other statistical approaches (such as the approaches used for research questions one and two as described in sections 4.2 and 5.2), thus, social network approaches consider not only the dependency of observations amongst students in the same class, but also a dependency of observations in regard to the social structure in a classroom (Robins, 2015).

The analysis concerning research question three was conducted in two steps. In the first step, for each class an Exponential Random Graph Model (ERGM) in regard to friendships and negative relationships between the students in a class was estimated (see section 6.1.1; Boda & Néray, 2015; Huitsing & Veenstra, 2012; McKay et al., 2017; Oldenburg et al., 2018). In the second step, the class-wise estimated parameters were combined by computing a meta-analysis for each parameter calculated. For the meta-analysis, the parameters computed for each classroom individually were combined and their relative importance in regard to all the classrooms considered could be estimated. Accordingly, with the results of this meta-analysis a judgment could be made as to whether a parameter was relevant in regards to all the classes in the present

sample. This is a common approach in social network analysis (Boda & Néray, 2015; Huitsing & Veenstra, 2012; McKay et al., 2017; Oldenburg et al., 2018).

The whole analysis described was conducted twice in order to obtain results on the attribute configuration concerning state self-reported engagement and state on-task engagement separately. Note, however, that the descriptive statistics for the social networks are described only once, because they do not differ between the two analyses.

6.2.1 Step one: Exponential Random Graph Models (ERGM)

ERGMs originated from the field social network research. Constituting a modelling approach for cross-sectional relationship data, ERGMs are "statistical models for network structure, permitting inferences about how network ties are patterned" (Lusher et al., 2013, p. 9). The key interest in the findings of the ERGM models, thus, lies in examining which relationship patterns (configurations) are likely to occur in a given network. Configurations can include dyadic (pairwise) relations, triads (relationships among three students), and other larger relationship structures. The examination of the relationship patterns allows inferences to be made about the underlying processes of network creation and relationship sustainment in a given network (Lusher et al., 2013). **Table 21** shows the configurations included in the present ERGM estimations. These configurations can be understood as the underlying hypotheses of the ERGM social network analysis model. Configurations can be about only the relationship patterns between students, or can include student attributes. An example of a configuration that describes the relationship structure between students is 'reciprocity'. Reciprocity indicates that students are likely to be nominated by classmates that they also nominate (reciprocal relationships). An example of a configuration including student attributes would be the 'gender-difference' configuration. In a friendship network, this configuration indicates that students of a different gender are less likely to be friends. In non-technical language, this hypothesis could be that students

are less likely to nominate classmates of a different gender as friends, or, as stated earlier, with the expectation of a negative parameter estimate, that students are more likely to nominate classmates of the same gender as friends.

When an ERGM estimation is conducted, certain general assumptions about the social network examined have to be considered. For the present dissertation, accordingly, several general social network configurations (GSNCs) relating to class networks in elementary school were taken into account. These configurations do not directly relate to hypotheses outlined in the theoretical background (section 2) of this dissertation, but were derived from prior social network research which implemented ERGMs in the school context (e.g., Boda & Néray, 2015; Huitsing & Veenstra, 2012).

ERGM model estimations follow an iterative approach. For each class, in a first step, an ERGM model of friendship and an ERGM model of negative relationships with the configurations in **Table 21** were estimated. In order to obtain satisfactory goodness of fit, the *t-ratio* of the estimated configurations needed to be lower than 0.1 and the *t-ratio* of all other possible configurations had to be lower than 4. In the case of four classes, in terms of the negative seating network, a transitive closure had to be added in order to achieve satisfactory goodness of fit. For some classes, some of the general social network configurations (GSNCs) chosen had to be removed from the model because they did not describe the relevant class's social structures well. To add or remove certain GSNC-related configurations in the process of estimating ERGMs is part of the usual ERGM estimation approach (Lusher et al., 2013). After this iterative process, when satisfactory goodness of fit had been achieved for all classes, the data was ready for the meta-analysis described below as the second step of the analysis.

6.2.2 Step two: Meta-analysis of the parameters estimated using the ERGMs

In order to combine the individual estimations for each class and obtain a deeper understanding of which mechanisms are important in regard to all classes in the present sample, the estimated parameters of all classes were evaluated together, in a second step, in a meta-analysis (Boda & Néray, 2015; Huitsing & Veenstra, 2012; McKay et al., 2017; Oldenburg et al., 2018).

For the meta-analysis a random effects meta-analysis model with a restricted maximum likelihood estimator (REML) and the Hartung-Knapp adjustment were applied. A random effects model was chosen, because it cannot be assumed that the assignment of students into classes (the units of the meta-analysis) from the whole sample or population of students was random. The random effects model estimation (in contrast to the fixed effect model) allows for a possible variability between the estimates of different units of the meta-analysis and, hence, is preferable in the present study. The REML estimator and the Hartung-Knapp adjustment were applied because they showed superior performance in Monte Carlo simulations and analytical comparisons (Schwarzer et al., 2015).

6.3 Descriptive statistics for the class social networks

In **Table 22** an overview of the descriptive statistics for the social network models can be found. In the following, the social network statistics in **Table 22** are explained and described. For example, whenever a student names a classmate as a friend, this is considered a nomination. The total number of nominations is higher for the friendship network than the negative seating network. The density of a social network refers to how interconnected students are within their class social network. The statistic is calculated by dividing the number of nominations by the number of possible nominations in a social network. If a class friendship network has a high density, this means that most students in the class nominate one another as friends. If a class friendship network has a low density, this means that there are only a few students in the class

sharing a friendship, and the class as a whole might be more fragmented. In the student trait questionnaire, students were allowed to nominate between zero and five classmates. Accordingly, the number of possible nominations and the density of the class networks were calculated by, first, considering the maximum of five nominations per student and, second, by not considering the maximum of five nominations per student. The latter calculation was necessary to be able to compare the density of the class networks to the density found in prior studies, which did not restrict the number of nominations. The resulting average densities (and the further statistics described below) for the friendship and negative seating networks are comparable to the statistics from an earlier study by Huitsing and Veenstra (2012), which investigated general like and dislike student networks of elementary school students in mainland Finland. Accordingly, allowing students to nominate a maximum of five classmates seems to have been sufficient to capture the class social networks.

Indegree in a social network describes the number of nominations a student receives, while outdegree describes the number of nominations that a student makes. As can be seen in **Table 22**, the average proportion of indegree over outdegree for both types of class networks is close to 1. This indicates that generally students are nominated approximately the same number of times as they nominate classmates. The reciprocity statistic, however, indicates that a student is not always nominated by the student she or he nominates. In the friendship networks, on average only 16.8 percent of the nominations are reciprocated by classmates, and in the negative seating networks, this percentage is even smaller, with 6.1 percent of the nominations reciprocated.

Table 22

Descriptive statistics for the social network models (n = 588 students in n = 34 classes).

	Network	
	Friendship	**Negative seating**
Number of classrooms analyzed	34	34
Total number of nominations	1,978	1,539
Total number of possible nominations (considering the maximum of 5 nominations per student)	2,940	2,940
Total number of possible nominations (*not* considering the maximum of 5 nominations per student)	9,842	9,842
Average density (considering the maximum of 5 nominations per student)	67.0% (*SD* = 12.0%)	51.0% (SD = 15%)
Average density (*not* considering the maximum of 5 nominations per student)	21.0% (SD = 6.0%)	16.0% (SD = 4.0%)
Average proportion of indegree over outdegree	1.05	1.13
Standard deviation of indegree	1.97	2.47
Standard deviation of outdegree	1.32	1.48
Average reciprocity	16.8% (SD = 7.3%)	6.1% (SD = 4.7%)
Total number of students with zero outdegree (sinks)	30	86
Percentage of sinks	5.10	14.63
Total number of students with zero indegree (sources)	41	97
Percentage of sources	6.97	16.50
Total number of isolates	3	27
Percentage of isolates	0.51	4.59

It is interesting to note that 5.10 percent of the students were nominated as friends but did not name any classmates as friends and 14.63 percent of the students were nominated in the negative seating network but did not make any negative seating nominations (sinks). In the friendship network, 6.97 percent of the students and in the negative seating network, 16.50 percent of the students nominated other students but did not receive nominations from other students (sources). Additionally, only 0.51 percent of all students neither gave nor received friendship

nominations and 4.59 percent of all students neither made nor obtained any negative seatmate nominations (isolates). Accordingly, it seems that the majority of students were embedded in the class networks. Further, the frequency of the absence of negative nominations was higher than the frequency of the absence of positive nominations, and most students were able to name best friends in class or were nominated as best friends.

6.4 Model estimates for friendship networks

Table 23 summarizes the results of the meta-analyses of the friendship networks. In the following, the social network configurations in **Table 23** are described. It was found that student A, for example, is more likely to be named by a classmate B as their best friend if student A also names B as their best friend (i.e., reciprocated relationships compared to non-reciprocated relationships: ('Reciprocity', model of self-reported engagement: $\beta = 1.68$, $p < 0.001$, model of on-task engagement: $\beta = 1.66$, $p < 0.001$). For the present friendship networks, cluster-formation ('Transitive closure', model of self-reported engagement: $\beta = 0.48$, $p < 0.001$, model of on-task engagement: $\beta = 0.50$, $p < 0.001$) was more characteristic than connectedness ('Multiple two-paths', model of self-reported engagement: $\beta = -0.36$, $p < 0.001$, model of on-task engagement: $\beta = -0.37$, $p < 0.001$, and 'Shared in-ties', model of self-reported engagement: $\beta = -0.21$, $p = 0.008$, model of on-task engagement: $\beta = -0.18$, $p = 0.012$). It was, thus, more likely to find befriended subgroups of students in a class, than it was to find all students in a class as a whole homogeneously sharing friendship relationships (i.e., all students of a class being befriended with one another).

In terms of the attribute-related configurations, the relative motivation score did not predict the likelihood of making friendship nominations ('Motivation-sender', both models $p > 0.05$). Students with a state engagement lower than the class's average state engagement are more likely

to be nominated as best friends ('Engagement-Receiver', model for self-reported engagement: β = -0.04, p = 0.033, model for on-task engagement: β = -0.14, p = 0.049). Students are more likely to be nominated as a best friend if they are of the same gender ('Gender-Difference', model of self-reported engagement: β = -0.50, p < 0.001, model of on-task engagement: β = -0.71, p < 0.001). Further, it was found only in the model of state self-reported engagement that classmates similar in state intrinsic motivation were more likely to be nominated as best friends by students ('Motivation-Difference', model of self-reported engagement: β = -0.06, p = 0.039, model of on-task engagement: p > 0.05).

Table 23

Results of the meta-analyses of the friendship network models (n = 588 students in n = 34 classes, one-tailed p-values).

Configuration		**Model for self-reported engagement**				**Model for on-task engagement**				
	n	*Est.*	*95%CI*	*t*	*p*	*n*	*Est.*	*95%CI*	*t*	*p*
Reciprocity	32	1.68	[1.42; 1.93]	11.91	< 0.001	33	1.66	[1.38; 1.93]	12.25	< 0.001
AT-T	34	0.48	[0.40; 0.56]	11.89	< 0.001	34	0.50	[0.42; 0.58]	12.39	< 0.001
A2P-T	34	-0.36	[-0.43; -0.29]	-10.60	< 0.001	34	-0.37	[-0.43; -0.31]	-11.82	< 0.001
A2P-D	34	-0.21	[-0.38; -0.05]	-2.58	0.008	34	-0.18	[-0.34; -0.02]	-2.35	0.012
Motivation - Sender	31	-0.01	[-0.06; 0.05]	-0.23	0.409	31	-0.04	[-0.09; 0.01]	-1.68	0.051
Engagement - Receiver	32	-0.04	[-0.08; 0.01]	-1.92	0.033	31	-0.14	[-0.31; 0.03]	-1.71	0.049
Gender - Difference	30	-0.50	[-0.69; -0.31]	-5.34	< 0.001	27	-0.71	[-0.92; -0.50]	-6.92	< 0.001
Motivation - Difference	32	-0.06	[-0.12; 0.01]	-1.83	0.039	31	-0.03	[-0.09; 0.03]	-1.12	0.135

Similar to the findings of previous social network studies, a significant heterogeneity of parameter estimates between classes (*Cochran Q*-test) was found concerning most configurations (p

≤ 0.007; see **Table 24** and **Table 25**). The configurations 'Motivation-Sender' and 'Engagement-Receiver', however, did not show a significant heterogeneity between classes (all $p > 0.1$; irrespective of whether the model of state self-reported engagement or state on-task engagement was considered). Accordingly, the estimates of these two configurations are similar across all participating classes.

Table 24

Heterogeneity tests for the friendship network meta-analyses of state self-reported engagement (Tau2, I2, and Cochran Q-test).

		Tau2		I2		Cochran-Q-Test		
Configuration	*n*	Estimate	95%CI	Estimate	95%CI	Q	df	p-value (2-sided)
Reciprocity	32	0.26	[0.10; 0.98]	49.7%	[24.8%; 66.4%]	63.63	32	0.001
AT-T	34	0.01	[0.01; 0.12]	50.0%	[25.6%; 66.3%]	65.95	33	0.001
A2P-T	34	0.02	[0.01; 0.07]	52.4%	[29.6%; 67.8%]	69.34	33	< 0.001
A2P-D	34	0.14	[0.07; 0.35]	64.6%	[49.0%; 75.4%]	93.2	33	< 0.001
Motivation - Sender	31	0.01	[0.00; 0.03]	16.3%	[00.0%; 46.3%]	35.83	30	0.210
Engagement - Receiver	32	0.01	[0.00; 0.01]	18.8%	[00.0%; 47.7%]	38.2	31	0.175
Gender - Difference	30	0.05	[0.04; 1.02]	49.40%	[22.8%; 66.9%]	57.34	29	0.001
Motivation - Difference	32	0.01	[0.01; 0.04]	49.3%	[23.6%; 66.3%]	61.14	31	0.001

Table 25

Heterogeneity tests for the friendship network meta-analyses of state on-task engagement (Tau2, I2, and Cochran Q-test).

		Tau2		I2		Cochran-Q-Test		
Configuration	*n*	Estimate	95%CI	Estimate	95%CI	Q	df	p-value (2-sided)
Reciprocity	33	0.30	[0.10; 0.77]	51.6%	[27.8%; 67.5%]	66.11	32	< 0.001
AT-T	34	0.02	[0.01; 0.08]	47.4%	[21.5%; 64.8%]	62.75	33	0.001
A2P-T	34	0.01	[0.00; 0.06]	44.2%	[16.2%; 62.8%]	59.16	33	0.003
A2P-D	34	0.12	[0.06; 0.29]	65.0%	[49.6%; 75.6%]	94.2	33	< 0.001
Motivation - Sender	31	0.00	[0.00; 0.03]	15.5%	[0.0%; 45.7%]	35.5	30	0.225
Engagement - Receiver	31	0.01	[0.00; 0.23]	0.0%	[0.0%; 40.2%]	29.78	30	0.477
Gender - Difference	27	0.11	[0.04; 0.49]	53.40%	[27.8%; 69.9%]	55.77	26	0.001
Motivation - Difference	31	0.01	[0.0 ; 0.03]	42.5%	[11.8%; 62.5%]	52.16	30	0.007

6.5 Model estimates of dislike seating networks

Table 26 summarizes the results of the meta-analyses of the friendship networks. In the following, the social network configurations in **Table 23** are described.

It was found that the likelihood of being nominated as a negative seatmate is higher for classmates that students themselves nominate as a negative seatmate ('Reciprocity', model of self-report engagement: $\beta = 0.73$, $p < 0.001$, model of on-task engagement: $\beta = 0.74$, $p < 0.001$). In the present negative seating networks, most students sent out many negative seatmate nominations, generally using up their five possible nominations ('Out-ties-spread', model of self-reported engagement: $\beta = 1.03$, $p < 0.001$, model of on-task engagement: $\beta = 1.01$, $p < 0.001$). The number of nominations received by students, however, varied substantially ('In-ties-

spread', model of self-reported engagement: $p > 0.1$, model of on-task engagement: $p > 0.1$). Accordingly, some students would receive few nominations and some students would receive many nominations, but no general pattern became visible. In the present classes it was generally unlikely that the same path of negative relationships occurred multiple times ('Multiple two-paths', model of self-reported engagement: $\beta = -0.16$, $p < 0.001$, model of on-task engagement: $\beta = -0.15$, $p < 0.001$). Accordingly, for example, it would be unlikely that student A nominates students B and C as disliked seatmates, and that students B and C would both further nominate student D as a common disliked seatmate. Further, it was unlikely that the same combinations of student nominations as disliked seatmates would occur frequently in a classroom ('Shared in-ties', model of self-reported engagement: $\beta = -0.82$, $p < 0.001$ model of on-task engagement: $\beta = -0.86$, $p < 0.001$). Additionally, it was likely that students were nominated as disliked seatmates that were already nominated by other classmates ('Shared out-ties', model of self-report engagement: $\beta = 0.15$, $p < 0.001$, model of on-task engagement: $\beta = 0.14$, $p = 0.002$).

In terms of the attribute-related configurations, in the model of state on-task engagement, students with state intrinsic motivation higher than the class's average were less likely to make negative seatmate nominations ('Motivation-sender', model of self-reported engagement: $p > 0.05$, model of on-task engagement: $\beta = -0.15$, $p = 0.001$). Students with state engagement lower than the class's average state engagement are more likely to be nominated as disliked seatmates ('Engagement-Receiver', model of self-reported engagement: $\beta = -018$, $p = 0.026$, model of on-task engagement: $\beta = -0.27$, $p = 0.014$). In the model of state on-task engagement, students are more likely to be nominated as disliked seatmates, if they are of the other gender ('Gender-Difference', model of self-reported engagement: $p > 0.1$, model of on-task engagement: $\beta =$

0.34, $p = 0.004$). Further, the similarity of state intrinsic motivation did not systematically contribute to the likelihood of being nominated as a disliked seatmate ('Motivation-Difference', both models $p > 0.1$).

Table 26

Results of the meta-analyses of the dislike seating network models (n = 588 students in n = 34 classes, one-tailed p-values).

Configuration	Model of self-reported engagement					Model of on-task engagement				
	n	*Est.*	*95%CI*	*t*	*p*	*n*	*Est.*	*95%CI*	*t*	*p*
Reciprocity	34	0.73	[0.49; 0.98]	6.02	< 0.001	33	0.74	[0.49; 0.99]	6.07	< 0.001
AinS	34	-0.20	[-0.53; 0.13]	-1.23	0.113	34	-0.18	[-0.47; 0.11]	-1.24	0.111
AoutS	34	1.03	[0.61; 1.46]	4.94	< 0.001	34	1.01	[0.55; 1.47]	4.48	< 0.001
A2P-T	34	-0.16	[-0.23; -0.10]	-5.00	< 0.001	34	-0.15	[-0.22; -0.09]	-4.74	< 0.001
A2P-D	34	-0.82	[-1.03; -0.60]	-7.77	< 0.001	34	-0.86	[-1.05; -0.67]	-9.12	< 0.001
A2P-U	34	0.15	[0.08; 0.22]	4.37	< 0.001	34	0.14	[0.05; 0.24]	3.11	0.002
Motivation - Sender	32	-0.10	[-0.24; 0.05]	-1.4	0.086	31	-0.15	[-0.25; -0.06]	-3.24	0.001
Engagement - Receiver	32	-0.18	[-0.36; 0.01]	-2.02	0.026	31	-0.27	[-0.51; -0.03]	-2.30	0.014
Gender - Difference	31	0.14	[-0.18; 0.46]	0.90	0.189	30	0.34	[0.09; 0.60]	2.82	0.004
Motivation - Difference	32	-0.03	[-0.16; 0.10]	-0.46	0.325	31	-0.02	[-0.08; 0.04]	-0.62	0.272

Similar to the results from previous social network studies, a significant heterogeneity of parameter estimates between classes (*Cochran Q*-test) was found concerning most configurations ($p \leq 0.043$; see **Table 27** and **Table 28**). Only the configuration 'Reciprocity' did not show a significant heterogeneity between classes (both models $p > 0.1$, irrespective of whether the model with state self-reported engagement or state on-task engagement is considered). Accordingly, the estimates for this configuration are similar across all participating classes.

Table 27

Heterogeneity tests for the negative seatmate network meta-analyses of state self-reported engagement (Tau2, I2, and Cochran Q-test).

		Tau2		I2		Cochran-Q-Test		
Configuration	*n*	Estimate	95%CI	Estimate	95%CI	Q	df	p-value (2-sided)
Reciprocity	34	0.03	[0.00; 0.49]	11.4%	[0.0%; 41.6%]	37.23	33	0.281
AinS	34	0.28	[0.02; 1.10]	37.6%	[5.4%; 58.8%]	52.88	33	0.016
AoutS	34	0.56	[0.05; 1.67]	38.7%	[7.2%; 59.5%]	53.83	33	0.013
A2P-T	34	0.02	[0.01; 0.05]	54.2%	[32.4%; 68.9%]	71.98	33	< 0.001
A2P-D	34	0.15	[0.02; 0.42]	39.7%	[8.8%; 60.1%]	54.7	33	0.010
A2P-U	34	0.01	[0.01; 0.05]	36.1%	[3.0%; 57.9%]	51.64	33	0.021
Motivation - Sender	32	0.05	[0.08; 1.25]	71.7%	[59.7%; 80.1%]	109.57	31	< 0.001
Engagement - Receiver	32	0.07	[0.24; 1.42]	78.5%	[70.1%; 84.5%]	144.06	31	< 0.001
Gender - Difference	31	0.39	[0.26; 1.61]	70.2%	[57.1%; 79.3%]	100.77	30	< 0.001
Motivation - Difference	32	0.02	[0.46; 3.53]	73.6%	[62.7%; 81.4%]	117.48	31	< 0.001

Table 28

Heterogeneity tests for the negative seatmate network meta-analyses of state on-task engagement (Tau2, I2, and Cochran Q-test).

		Tau2		I2		Cochran-Q-Test		
Configuration	*n*	Estimate	95%CI	Estimate	95%CI	Q	df	p-value (2-sided)
Reciprocity	33	0.10	[0.00; 0.34]	5.2%	[0.0%; 34.9%]	33.77	32	0.382
AoutS	34	0.80	[0.22 2.15]	49.6%	[25.0%; 66.1%]	65.44	33	0.001
AinS	34	0.19	[0.00; 0.81]	31.5%	[0.0%; 55.1%]	48.2	33	0.043
A2P-T	34	0.02	[0.01; 0.05]	50.7%	[26.8%; 66.8%]	66.93	33	< 0.001
A2P-D	34	0.12	[0.02; 0.32]	47.7%	[22.0%; 65.0%]	63.11	33	0.001
A2P-U	34	0.02	[0.01; 0.16]	55.9%	[35.2%; 70.0%]	74.84	33	< 0.001
Motivation - Sender	31	0.03	[0.02; 0.11]	59.5%	[39.9%; 72.7%]	74.07	30	< 0.001
Engagement - Receiver	31	0.03	[0.22; 3.17]	54.6%	[31.9%; 69.8%]	66.13	30	< 0.001
Gender - Difference	30	0.25	[0.12; 0.71]	68.0%	[53.4%; 78.1%]	90.71	29	< 0.001
Motivation - Difference	31	0.01	[0.00; 0.05]	32.8%	[0.0%; 56.8%]	44.67	30	0.041

6.6 Discussion concerning research question three

Prior research indicates that classmates can affect student engagement during class in elementary school (e.g., Appel, 2015; Figlio, 2007; Wettstein et al., 2010). Nevertheless, generally, when investigating student engagement, “researchers have focused more on teachers and parents than peers as socializing agents of motivation and engagement” (Ryan, 2000, p. 101). Several authors claim that there is a research gap in the area of how classmates affect student engagement during class (e.g., Eccles et al., 1998; Kindermann et al., 1996; Rubin & Hebert, 1998; Urdan & Schoenfelder, 2006; Urdan & Turner, 2005). Research question three tackles

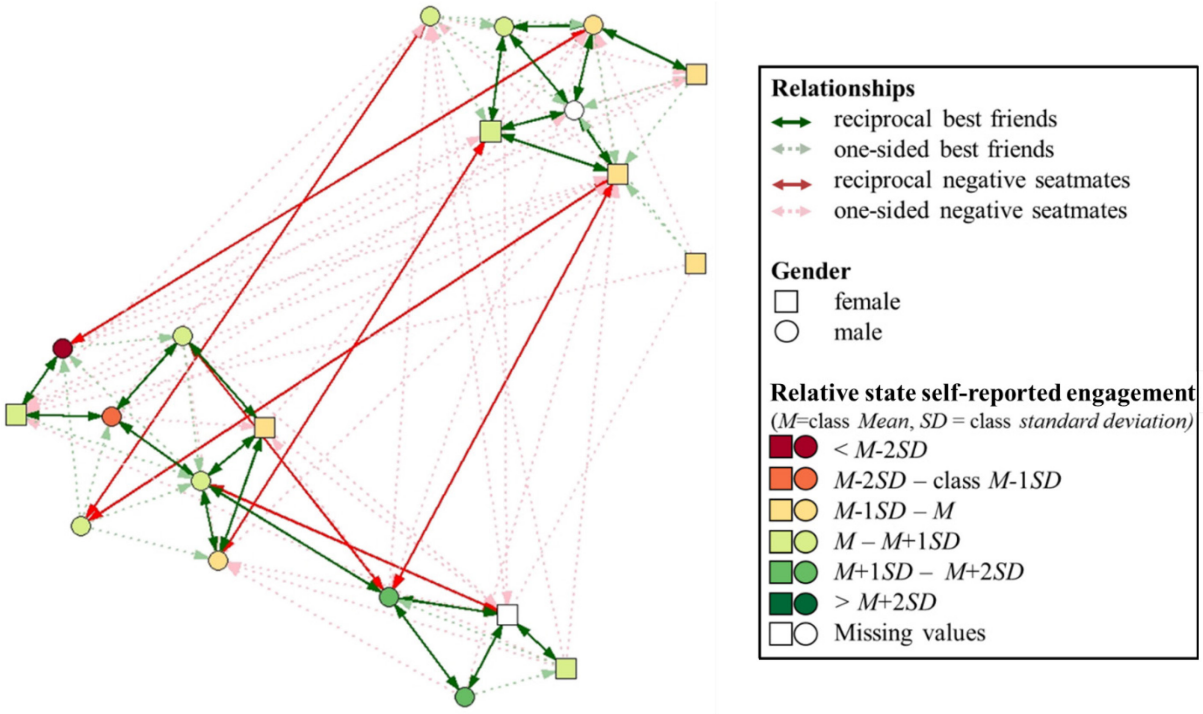
this research gap by investigating how friendships and negative relationships in a classroom are associated with student motivation and engagement during class.

6.6.1 Prototypical class network graph

To visualize the findings from the ERGM analysis, which resulted in a meta-analysis of all classes, a social network graph of a prototypical class was drawn (see **Figure 17**). The choice of the class followed the closest match criteria: For each parameter estimate resulting from the meta-analyses of both analyses (self-reported and on-task engagement), the class with the closest matching parameter estimate was determined. Then, the class with the closest matching parameter estimates in both analyses was chosen and drawn as a network graph. The resulting network graph of the prototypical class network is depicted in **Figure 16**. In the social network graph, the circles / squares stand for the students in the class. Female students are represented by squares, male students by circles. The color filling the circle / square stands for the state self-reported engagement of a student. Dark red stands for very low engagement, dark green for very high state self-reported engagement (compared to the other students in class). Further, the social network graph shows lines between the students. These arrows stand for the relationships in the class. In the graph, reciprocal ties are differentiated from one-sided relationship nominations to simplify the reading of the graph. Accordingly, a dark green solid line, representing a reciprocal tie, is drawn if a student nominating a classmate is nominated back as a friend. A light green dotted line is drawn if only one of the students was nominating the other as a best friend. The same logic was applied to the negative seatmate relationships in red. Dark red solid lines represent reciprocal nominations and light red dotted lines represent one-sided negative seatmate nominations. The array of students in the network graph is based on friendship relationships. Accordingly, students who are friends are closer than students not connected by a friendship tie.

Figure 17

Prototypical class network (n = 20 students).



In this prototypical network graph, several aspects of the results are visible. In this class, three friendship groups appear. Within these groups, most students are connected through reciprocal friendship ties and there are no reciprocal negative seatmate ties present within a group. Between the friendship groups, there are several negative seatmate ties present. Interestingly, there is one reciprocal friendship relationship connecting the lower two groups. Such relationships are also called 'bridges' in social network terms, as they connect/bridge otherwise sparsely connected subparts of a network (Granovetter, 1983).

Three students, a female and two male students, do not share any reciprocal friendship ties. While the female student only sends out (positive and negative) ties, the male students receive several one-sided negative seatmate ties and at least one reciprocal negative seatmate tie. These three students seem to be less embedded in the social structure of the class.

The friendship groups in the class are often mixed in regard to gender. Nevertheless, students of the same gender seem to be more strongly positively connected within the groups. Interestingly, only male students share reciprocal negative seatmate ties with other students of the same gender. For female students, this type of reciprocal tie does not occur within the present class network. Unfortunately, the effect of relative state self-reported engagement is not directly apparent from the class's social network graph. It seems, however, that the two medium green male students on the lower right, possess fewer friendship ties (usually reciprocated) than other students more in the yellowish / reddish color range of relative state self-reported engagement.

6.6.2 Student engagement and social relationships in class

The results indicate that students with an engagement rating slightly lower than the class average are generally more frequently named as friends by their classmates. Accordingly, hypothesis 4c, which proposed that students with high engagement are more likely to receive friendship nominations, cannot be confirmed.

On the other hand, students displaying much lower engagement during class than the average of their classmates, are generally likely to be named as classmates that students dislike sitting next to in class. This latter finding is congruent with hypothesis 4d, which proposed that students with low engagement are more likely to receive disliked seatmate nominations.

The two above mentioned findings are consistent across both types of measurements of state student engagement (self-reported and on-task). Moreover, in regard to the first effect found concerning the friendship networks, no heterogeneity concerning this effect between the different classes was found, indicating that it might be a rather stable effect.

The findings are consistent with the findings of a case study of 22 students in a fifth grade classroom by Sage and Kindermann (1999, p. 143) regarding student motivation: " The more

students were motivated, the more likely they were to receive approval from peer group members following their active on-task behaviors. The less students were motivated, the more they received disapproval from nonmembers following their disruptive off-task behaviors". A possible explanation for the findings described could be that there are multiple reasons for peer rejection in a classroom. On one hand, students displaying aggressive, disengaged behavior might be rejected by their classmates because they display a large negative deviation from classroom engagement social norms (Buhs et al., 2006). On the other hand, students showing high engagement, higher than the average student in the classroom, might also be rejected by their classmates, as these students positively deviate from their classroom's behavioral social norm. Accordingly, peer rejection could be associated in a 'U'-shape with student engagement in class, whereas medium engagement might be associated with high student acceptance in class. This finding is consistent with the findings of (Engels et al., 2017, p. 61), which indicated that "adolescents' popularity may interfere with meeting academic demands in general and with showing engagement in particular".

6.6.3 Intrinsic motivation and social relationships in class

In terms of the interrelationship between intrinsic motivation and social relationships in class, the findings are not as clear as in regard to student engagement.

Hypothesis 4d, which proposed that students with high intrinsic motivation are less likely to reject classmates, can only be confirmed in regard to state on-task student engagement. This finding is in line with those of previous work (Juvonen et al., 2012; Ladd & Dinella, 2009). For state self-reported engagement, the parameter indicates a similar direction, but is not significant. Furthermore, there seems to be heterogeneity between the classes in terms of this effect, indicating that it does not occur in all the classes. Accordingly, it might be a small, unstable effect.

Concerning hypotheses 4g and 4h, which proposed that students with a similar level of intrinsic motivation are more likely to be friends (hypothesis 4g), and that students with a different level of intrinsic motivation are more likely to be rejected (hypothesis 4h), only hypothesis 4g regarding the friendship networks could partially be confirmed. The more similar students' intrinsic motivation was, the more likely they were to name each other as friends. This finding is in line with those of work proposing that similarity promotes friendship (Robins, 2015; Youniss, 1982).

7 General discussion

In the current section, first, the most important results concerning student engagement from the preceding separate discussion sections related to the three research questions are summarized. Second, the theoretical, methodological, and disciplinary contributions of this dissertation are discussed. Third, limitations of this dissertation are presented and, fourth, avenues for future research are discussed. Lastly, a conclusion is presented.

7.1 Summary of the most important results for student engagement in class

In terms of student engagement, several main findings can be summarized from the investigation of the three research questions throughout the last sections. Research question one investigated how different operationalizations of student engagement during class relate. Research question two examined how aspects of internal and external regulation (i.e. intrinsic and extrinsic motivation, self-control and perceived behavior of classmates) are related to student engagement in class. Research question three used positive and negative class social networks to study how student motivation and engagement are associated with the relationship structure in class.

7.1.1 Summary regarding research question one

Research question one investigated the relationships between the three different measures (trait student engagement, state self-reported student engagement and state observation of student engagement) which were used to triangulate student engagement during class.

The results indicate, firstly, that the three instruments of student engagement seem to be triangulating the same concept of student engagement during class from different perspectives. The measures seem to capture different parts of substantial and procedural student engagement during class and differ in regard to their trait-related versus state-related nature. This finding is

congruent with those of the literature, which posited that it is important to consider and investigate differences between operationalizations of student engagement in regard to their interpretation (e.g., Knogler & Böheim, 2019; Martins et al., 2022; Sinatra et al., 2015; Skinner et al., 2009; Spanjers et al., 2008).

Secondly, the triangulation of student engagement made visible a comparison referent effect in regard to student engagement, similar to the 'big-fish-little-pond-effect' (Dijkstra et al., 2008; Marsh & Parker, 1984) and congruent with the theory of social comparison processes by Festinger (1954). Students compare themselves with their classmates in order to make a judgment of their own engagement in class. Consequently, their classmates' engagement serves students as a comparative standard and as a guide to what constitutes 'normal' engagement during class. This finding is of high relevance regarding student engagement in several ways. On the one hand, it again posits the importance of the consideration of the operationalization of student engagement, which has been previously discussed (Knogler & Böheim, 2019; Martins et al., 2022; Sinatra et al., 2015; Skinner et al., 2009; Spanjers et al., 2008). The finding of the social referent effect indicates that self-reports regarding student engagement are dependent on the classmates present as a social referent group. Accordingly, there is usually a class bias present in self-reported instruments of student engagement that should be considered (e.g., by implementing statistical modelling techniques that consider social dependencies, such as multilevel or social network models). Regarding class bias and the need to consider it statistically, it is questionable whether it would not be preferable to implement other types of self-reported measures of student engagement that explicitly consider class bias in the answer options. For example, instead of making an agreement rating regarding a statement, students could be explicitly asked how they perceive themselves in comparison to other students in class (rank rating, e.g., Cimeli et al., 2013; Compagnoni, 2021). Such an answer scale seems to be more

easily understandable for children than an agreement scale and has already been implemented successfully with very young kindergarten children (Cimeli et al., 2013; Compagnoni, 2021). Regarding further theoretical and practical implications of this finding, it is important to strengthen the awareness on the part of educators of the need to consider the social embeddedness of student engagement. While most traditional models focus on the individual student, this dissertation, in line with recent reviews (Martins et al., 2022; Mascareño Lara et al., 2023), emphasizes the importance of considering and investigating the (social) context in which student engagement is embedded. In terms of interventions to foster student engagement, Wigfield and Koenka (2020, p. 4) state that regarding motivation "what might be most important to consider is not merely the presence or absence of social comparisons but rather how educators and other socializers present them to students". It would, thus, be interesting to investigate how educators can utilize such automatic, social comparison processes to construct a class climate in which social relationships in class positively foster student engagement.

A third result is related to a gender difference observed regarding the measurements of student engagement. In the state self-reported measurement of student engagement, boys generally estimate their engagement higher than girls do. Nevertheless, when looking at the state on-task measurement of student engagement, boys are rated as less engaged than girls. This latter finding is congruent with earlier observational findings regarding student engagement (e.g., Appel, 2015; Godwin et al., 2016). This finding indicates that boys might be overconfident about their own engagement in class. This might be due to a generally higher self-concept on the part of boys than on the part of girls (e.g., Preckel et al., 2008; Skaalvik & Skaalvik, 2004), or could also be due to different social expectations regarding the engagement of boys and girls in class, which are mirrored in the behavioral evaluation (e.g., Cialdini et al., 1990; Heyder et al., 2021; Jones & Myhill, 2004; Tyler & Boelter, 2008). It could, therefore, be interesting to

investigate further whom students choose as a social referent (group) to evaluate their own engagement in class.

Overall, the finding strengthens, first, the importance of considering the implications and meanings of the type of operationalization of student engagement chosen (e.g., Knogler & Böheim, 2019; Martins et al., 2022; Sinatra et al., 2015; Skinner et al., 2009; Spanjers et al., 2008), and, second, the pertinence of considering the social embeddedness of a student when investigating student engagement (e.g., Furrer et al., 2014; Mascareño Lara et al., 2023; Reeve, 2012; Sinatra et al., 2015; Volet et al., 2009).

7.1.2 Summary regarding research question two

Research question two investigated how aspects of internal and external regulation (i.e. intrinsic and extrinsic motivation, self-control and perceived behavior of classmates) are related to student state self-reported and on-task engagement in class.

In line with those of previous literature, the results indicate that students' self-control is positively associated with student engagement in class (e.g., Blair & Razza, 2007; Cappella et al., 2013; Rimm-Kaufman et al., 2009; Smith-Donald et al., 2007; Zhao et al., 2019). The findings indicate that not only on the individual level, but also on the class level, self-control has an important role, as classes with higher overall self-control show higher overall engagement in class than classes with lower overall self-control values. In congruence with the findings regarding research question one, this finding strengthens the importance of considering the social embeddedness of students and is in line with previous research (e.g., Furrer et al., 2014; Mascareño Lara et al., 2023; Reeve, 2012; Sinatra et al., 2015; Volet et al., 2009).

In accordance with the findings of prior work (Ainley et al., 2005; Ainley, Hidi, et al., 2002; Ainley, Hillman, et al., 2002), student engagement is higher for students enjoying the lesson and interested in the content of a lesson (i.e. students with higher intrinsic motivation). Similar

to the findings in terms of self-control, these findings indicate that this effect is also significant when looking at the class level. Classes with higher overall intrinsic motivation show higher overall student engagement in class when considering the state self-reported engagement operationalization. In congruence with findings discussed earlier and with those of prior research, this result reinforces the importance of considering the social embeddedness of students (e.g., Furrer et al., 2014; Mascareño Lara et al., 2023; Reeve, 2012; Sinatra et al., 2015; Volet et al., 2009). Nevertheless, this finding was not found for the observational state on-task operationalization of student engagement, possibly due to the different perspectives taken into account when utilizing a self-reported measure versus an observational measure (as discussed earlier regarding the findings for research question one), reinforcing the importance of the awareness of the implications and meanings of the type of operationalization of student engagement chosen (e.g., Knogler & Böheim, 2019; Martins et al., 2022; Sinatra et al., 2015; Skinner et al., 2009; Spanjers et al., 2008).

An association of the subjectively perceived classroom descriptive social norms (i.e. how students perceive their classmates' engagement) with student engagement, in line with results from prior research (e.g., Cialdini et al., 1990; Dishion & Tipsord, 2011; Hartup, 2009; Müller & Zurbriggen, 2016) was only found with the observational state on-task engagement operationalization. A possible interpretation of not finding the same effect with state self-reported engagement could be in line with the findings regarding the social referent effect and potential class bias discussed concerning research question one. While the self-report operationalization might already incorporate the student subjectively perceived descriptive social norm of student engagement, possibly masking the importance of considering the social context. On the other hand, the observational on-task operationalization, relying on defined categories of observational behaviors, does not entail such a class bias, possibly allowing for the unmasking of the

effect. Nevertheless, this interpretation is still somewhat speculative and needs further examination.

The findings show that extrinsic teacher-related and/or parent-related motivation is associated with low levels of student engagement. While the causality of the relationship remains unclear in the results, it still contributes to debate about whether extrinsic motivation is useful in fostering student engagement (Anderman & Dawson, 2011) by indicating a negative association. The results indicate that students with higher levels of student engagement do generally seem to place less importance on extrinsic motivation from teachers or parents.

In the light of all the results regarding research question two, it could be worth investigating to what extent extrinsic motivations (e.g., a reward-punishment system) might be helpful for students with difficulties regarding their engagement in class, and/or to what extent it might be sufficient to foster intrinsic motivation and positive descriptive social norms regarding student engagement in class, for example, by fostering the experience of social relatedness, autonomy, and competence in class (Furrer et al., 2014; Hornstra et al., 2020; Reeve, 2012).

7.1.3 Summary regarding research question three

Research question three investigated whether positive and negative class social networks are associated with student engagement during class.

The results demonstrate that not only class membership, but also positive and negative relationships within a class are associated with student engagement during class. Very high and very low engagement during class seem to be associated with being unpopular in class. This finding is consistent with the findings of a case study on student motivation (Sage & Kindermann, 1999), and might contribute to the literature on the association between social status in class and student engagement, which has provided mixed findings (e.g., Berg et al., 2015; Buhs et

al., 2006; Cappella et al., 2013; Cillessen & van den Berg, 2012; Estell et al., 2008; Farmer & Farmer, 1996; Juvonen et al., 2012; Ladd & Dinella, 2009).

In line with the findings from research questions one and two, the findings from research question three concerning student engagement also stress the importance of considering the social embeddedness of students in a class, and the subjective perception of the adequate level of student engagement.

7.2 Contributions of the present dissertation

The present dissertation contributes in several ways to the field of educational sciences. In the following, theoretical, methodical, and overarching disciplinary contributions are outlined.

7.2.1 Theoretical contributions

The present dissertation contributes to the understanding of student engagement in class by making multiple theoretical contributions.

Firstly, a synthesis of several models which include student engagement as a moderating variable for student achievement was provided. In addition, a systematic literature review on influences on procedural student engagement during class in elementary school, which contributed to the understanding and conceptualization of student engagement, was also provided.

Secondly, the dissertation demonstrates a social comparison referent effect (i.e. big-fish-little-pond effect) on student engagement in class by triangulating student engagement in class with different measurements. This finding suggests that students compare themselves with their classmates in order to gain an understanding of their own engagement. This finding is in line with those of other research on student engagement, which posits that social relationships might have an important role in student engagement in class (e.g., Mascareño Lara et al., 2023; Reeve, 2012; Sinatra et al., 2015; Volet et al., 2009).

Thirdly, the present dissertation proposes that internal and also external regulation are important for student engagement and, contrary to the method used in the majority of other research, considered them jointly in the analyses (Volet et al., 2009). The findings indicate that intrinsic motivation and self-control are important predictors of student engagement in class. While self-control, intrinsic motivation, and subjectively perceived classroom descriptive social norms have a positive influence on student engagement in class, extrinsic motivation related to teachers might negatively predict student engagement in class. It seems important to consider not only separately, but also jointly the possible impacts of internal and external regulation on student engagement (Martins et al., 2022; Volet et al., 2009).

Lastly, the present dissertation examined the impact of social relationships in class on student engagement. The findings indicate that students displaying an engagement level close to the average engagement level of all students in class benefit from more positive relationships and fewer negative relationships in class. This finding, in line with other results of the present dissertation, emphasized the importance of considering social embeddedness and social norms when examining student engagement (e.g., Cialdini et al., 1990; Dishion & Tipsord, 2011; Hartup, 2009; Mascareño Lara et al., 2023; Müller & Zurbriggen, 2016; Reeve, 2012; Sinatra et al., 2015; Volet et al., 2009).

7.2.2 Methodological contributions

The present dissertation contributes to methodological advancement in empirical investigation of student engagement in several ways. Firstly, it incorporates an observational measure of student engagement in addition to the questionnaire measures. This approach allows for the integration of observer perspectives on student engagement and provides a more comprehensive understanding of student engagement. As Sinatra et al. (2015) state, “each type of measure (i.e. self-report, observation, teacher ratings) has strengths and weaknesses. Ideally researchers will

combine instruments to better triangulate engagement as it occurs in their studies". Contrary to most studies on engagement, which take into account single measurements of engagement or combine student and teacher perspectives on student engagement, this dissertation triangulated student engagement using a trait measurement, a state self-reported measurement of students and an observational rating of student engagement by observers external to the class system, providing a different perspective on student engagement (Knogler & Böheim, 2019; Martins et al., 2022; Sinatra et al., 2015; Skinner et al., 2009; Spanjers et al., 2008).

Secondly, the dissertation focused on concrete lesson situations when investigating student engagement, rather than the broader understanding of student engagement as seen in several prior questionnaire studies relating to not only classroom situations, but also, for example, homework (Fredricks et al., 2004). Accordingly, the findings of this dissertation are more closely related to actual student engagement in class.

Thirdly, the sample consists of children in elementary school in contrast to the majority of prior work, which focused on adolescents and/or university students. Consequently, the dissertation contributes to the understanding of student engagement in this younger age group of students in fifth grade.

Fourthly, the present dissertation focuses on students' experiences of the lesson, compared to the majority of previous studies found in the literature review, which focused on teachers and teacher behavior influencing student engagement in class. Accordingly, the approach provides a more student-centered perspective.

Lastly, the analysis design takes the dependencies between students into account by considering the hierarchical nesting of the data (i.e. combining subject-related engagement with trait engagement in a multilevel structural equation model), and relationships between classmates (i.e.

by using a multilevel structural equation model with contextual effects and social network analysis models), reflecting the complex dependencies between students in a class.

7.2.3 Overarching disciplinary contributions

The present dissertation further contributes to the development of educational sciences in regard to student engagement by taking an interdisciplinary perspective from educational, social and motivational psychology on student engagement. Consequently, a holistic working model of student engagement, considering aspects of the individual, the social context, and the social form was constructed based on theoretical considerations. While the working model of the present dissertation currently, in line with the purpose of the dissertation, is intended to focus on the student level, the model could be expanded by integrating a stronger teacher focus.

7.3 Limitations

Several limitations of this dissertation need to be noted. Firstly, although a random stratified sampling approach (see section 3.3.1) was chosen, the fifth grade classes recruited cannot be seen as representative of fifth grade classes in Switzerland, because it proved to be difficult to enlist participating classes for the research project “Klassenteams”. A possible reason for the difficulty of recruitment lies in the nature of the project, involving not only the main class teacher, but also all teachers teaching a class. Accordingly, all teachers needed to agree to participate in the project for a class to be eligible for the project.

A second limitation, resulting partly from the design of the project “Klassenteams”, is that the data of the present dissertation does not present a complete design in regards to the distribution of subjects to the teachers. The combinations of teachers teaching subjects differed between the classes (i.e., in class A, a main class teacher taught English, while in class B, a subject teacher taught English) and it was not possible to randomize the combinations of teachers and subjects

over all the classes, because this was given by the schools, depending on the qualifications and/or availability of the teachers. In consequence, the number of observations varies between the eight possible combinations of subject and teacher.

A third limitation of the present dissertation is that the dissertation gives only a short-term perspective on the concepts and processes discussed, as the data was collected within the timeframe of two weeks per class and the data collection was not repeated after a longer time period. Accordingly, the dissertation does not allow for the making of any conclusions in a longitudinal manner.

A fifth limitation is that self-control was merely assessed by a questionnaire self-assessment measure. While both the self-control measurements and the student engagement measurements relied on adaptations of existing measurements, the resulting measurements showed certain similarities.

7.4 Further research

There is significant space for further research within a broader range of the working model of the present dissertation, as the present dissertation was not able to investigate everything in detail.

Firstly, it would be interesting to investigate the impacts of the instructional setting, the subject, and the teacher type on student engagement more precisely, and with a more suitable setting. For example, it would be interesting to delve more deeply into the various lessons and investigate how the change in the instructional setting might affect the engagement of students in class. Secondly, it would be interesting to investigate the different types of student engagement more closely by using a qualitative approach. For example, the students could be observed and filmed in a learning context and then interviewed on their own perceptions of the learning sequence in

order to obtain a deeper understanding of their engagement during learning (video-stimulated recall; e.g., Meier & Vogt, 2015).

Thirdly, it would be of interest to investigate further the effect of different types of extrinsic motivation in a school learning context with an experimental approach in order to be able to give clearer directions in regard to reward-punishment systems and/or other approaches (e.g., the experience of social relatedness, autonomy, and competence to promote intrinsic motivation; Furrer et al., 2014; Hornstra et al., 2020; Reeve, 2012) to fostering student engagement in class.

Fourthly, it would be interesting to add a teacher perspective on student engagement in class compared to the student self-perspective and the observational other-perspective included in the dissertation.

Lastly, a longitudinal approach would add significant value to the present research. It would be very interesting to investigate how self-control, motivation, and student engagement in fifth grade students evolve and affect one another in the longer term.

7.5 Conclusion

By taking a 'person-in-context' perspective on student engagement (e.g., Mascareño Lara et al., 2023; Sinatra et al., 2015), this dissertation strengthens the notion that not only internal regulation, but also external regulation plays an important role in regard to student engagement in class. This is in line with research that places importance on considering the social context of students when investigating student engagement (e.g., Furrer et al., 2014; Martins et al., 2022; Mascareño Lara et al., 2023; Reeve, 2012; Sinatra et al., 2015; Volet et al., 2009). In line with those of previous research (e.g., Ainley et al., 2005; Ainley, Hidi, et al., 2002; Ainley, Hillman, et al., 2002; Blair & Razza, 2007; Cappella et al., 2013; Cialdini et al., 1990; Dishion & Tipsord, 2011; Hartup, 2009; Müller & Zurbriggen, 2016; Rimm-Kaufman et al., 2009; Smith-Donald

et al., 2007; Zhao et al., 2019), the findings show that different types of internal and external regulation jointly have important impacts on student engagement in class.

Findings indicate that students compare themselves to their classmates in regard to student engagement. Consequently, classmates implicitly affect student engagement by providing a comparative standard for students to evaluate their own engagement in class. This finding is highly pertinent, on the one hand, in terms of the appraisal of self-reported operationalizations for student engagement, and, on the other hand, in terms of the consideration of social embeddedness when investigating or fostering student engagement in class (e.g., Cialdini et al., 1990; Furrer et al., 2014; Heyder et al., 2021; Jones & Myhill, 2004; Knogler & Böheim, 2019; Martins et al., 2022; Mascareño Lara et al., 2023; Reeve, 2012; Sinatra et al., 2015; Skinner et al., 2009; Spanjers et al., 2008; Tyler & Boelter, 2008; Volet et al., 2009).

Additionally, the findings indicate that complying with the student engagement norms in class is associated with the number of friends a student makes, contributing to the understanding from the literature on the association of social status in class and student engagement, which has provided mixed findings (e.g., Berg et al., 2015; Buhs et al., 2006; Cappella et al., 2013; Cillessen & van den Berg, 2012; Estell et al., 2008; Farmer & Farmer, 1996; Juvonen et al., 2012; Ladd & Dinella, 2009), and, again, reinforcing the importance of considering class social norms when looking at student engagement.

As a conclusion, this dissertation proposes that it is important not only to look at the individual student, but also to take a holistic perspective on student engagement and investigate how internal and external regulation might affect student engagement.

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Annex

A. Documentation of the first literature review on student engagement.

Main question: What does affect student engagement in class in elementary school?

Research terms:

Main term	*Alternative 1*	*Alternative 2*
Schülerengagement	student engagement	
Schulengagement	school engagement	
time on-task		
time off-task		
aktive Lernzeit	active learning time	
Unterrichtsstörungen	disruptive behavior	störendes Verhalten

Text criteria:

- Forschungsfrage: geht es wirklich um beobachtetes on- vs. off-task / Schülerengagement während der Unterrichtsstunde?
- Teilnehmende: Primarschule / elementary school
- peer reviewed

Databases:

- PsycInfo, 1806-
- Web of Science Core Collection
- ERIC, 1960-
- FIS Bildung Literaturdatenbank , 1980-
- Education Research Complete

Number of results:

- Total: 1055 texts
- First elimination: 435 texts
- Second elimination:181 texts
- Final number of relevant texts: 29

Research documentation:

Literatursuchen Datenbanken:

Datum	*Datenbank*	*NR*	*Stichwort*	*Filter*	*Anzahl Resultate*
09.03.2017	ERIC	S6	AB "time on task"	Limiters - Peer Reviewed Narrow by Subject: - elementary school students Narrow by Subject: - elementary secondary education Narrow by Subject: - elementary education Narrow by Subject: - time on task Search modes - Boolean/Phrase	65
		S5	AB "disruptive behavior"	Limiters - Peer Reviewed Narrow by Subject: - elementary secondary education Narrow by Subject: - elementary school students Narrow by Subject: - elementary education Search modes - Boolean/Phrase	211
		S4	AB "student engagement"	Limiters - Peer Reviewed Narrow by Subject: - elementary secondary education Narrow by Subject: - elementary education Search modes - Boolean/Phrase	353
		S3	AB "school engagement"	Limiters - Peer Reviewed Narrow by Subject: - elementary secondary education Narrow by Subject: - elementary school students Narrow by Subject: - elementary education Search modes - Boolean/Phrase	67
		S2	AB "active learning time"	Limiters - Peer Reviewed Search modes - Boolean/Phrase	6
09.03.2017	Education Research	S1	AB "time off task"	Limiters - Peer Reviewed	5

	Com- plete, PsycIN FO			Search modes - Boolean/Phrase	
		S6	AB "disruptive behavior"	Limiters - Scholarly (Peer Reviewed) Journals Narrow by Subject: - elementary school students Search modes - Boolean/Phrase	79
		S5	AB "student engagement"	Limiters - Scholarly (Peer Reviewed) Journals Narrow by Subject: - elementary school students Search modes - Boolean/Phrase	27
		S4	AB "school engagement"	Limiters - Scholarly (Peer Reviewed) Journals Narrow by Subject: - school environment Narrow by Subject: - student engagement Search modes - Boolean/Phrase	54
		S3	AB "active learning time"	Limiters - Scholarly (Peer Reviewed) Journals Search modes - Boolean/Phrase	14
		S2	AB "time off task"	Limiters - Scholarly (Peer Reviewed) Journals Search modes - Boolean/Phrase	19
		S1	AB "time on task"	Limiters - Scholarly (Peer Reviewed) Journals Narrow by Subject: - elementary school students Narrow by Subject: - time on task Search modes - Boolean/Phrase	52
09.03.2017	FIS Bildung Liter- aturdaten- bank	1	Freitext: "TIME ON TASK"	-	14
		2	Freitext: "TIME OFF TASK"	-	0

		3	Freitext: "AKTIVE LERNZEIT"	-	3
		4	Freitext: SCHULENGAGEMENT	-	7
		5	Freitext: SCHUELERGAGEMENT	-	0
		6	Freitext: UNTERRICHTSSTOERUNG	Schlagwörter: UNTERRICHTSSTOERUNG Schlagwörter: UNTERRICHT Schlagwörter: SCHULUNTERRICHT Schlagwörter: SCHUELER	47
		7	Freitext: "STOERENDES VERHALTEN"	-	5
13.03.2017	web of science core collection	1	"time on task"*school OR "time on task"*classroom		117
		2	"time off task"*school OR "time off task"*classroom		8
		3	"disruptive behavior"*classroom OR "disruptive behaviour"*classroom	Categories: Psychology educational, Psychology multidisciplinary, Psychology, Applied Psychology, Sociology, Multidisciplinary Sciences, Social Sciences Interdisciplinary, Psychology experimental, Education scientific disciplines	180
		4	"active learning time"		5
		5	"student engagement"*classroom observation OR "school engagement"*classroom observation		97

B. Documentation of the literature update 2023.

Main question:

Was beeinflusst die Beteiligung am Unterricht?

Research terms:

Student engagement

Main term	*Alternative 1*	*Alternative 2*
Schülerengagement	student engagement	involvement
Schulengagement	school engagement	engagement
time on-task		
time off-task		
aktive Lernzeit	active learning time	
Unterrichtsstörungen	disruptive behavior	störendes Verhalten
Beteiligung	student involvement	

Text criteria:

- Geht es wirklich um beobachtetes on- vs. off-task / Schülerengagement während der Lektion?
- Sind Einflüsse auf die Beteiligung beschrieben worden?
- Teilnehmende: Primarschule / elementary school / ca. 10-11 Jahre alt
- Artikel welche komplette Interventionsprogramme testen (und nicht konkrete Massnahmen), werden weggelassen, wenn konkrete Wirkmechanismen nicht klar werden
- nur Artikel in Sprachen, die ich verstehe (also z.B. keine in Japanisch geschriebene Artikel)
- nur Artikel, welche eine empirische Studie beschreiben (keine reviews/theorieartikel)
- nur Artikel, wo die Regulation/Motivation vom Beteiligungsverhalten unterscheidbar ist

Databases:

- PsycInfo, 1806-

- Web of Science Core Collection (Social Sciences & Humanities)
- ERIC, 1960-

Number of results:

- Total: 1619 texts
- First elimination: 1579 texts
- Second elimination:216 texts
- Final number of relevant texts added to the literature review from 2017: 13

Research results:

Datum	*Datenbank*	*Suche*	*Stichwort*	*Filter*	*Anzahl Resultate*
15.06.2023	Web of Science Core Collection	Titel	((TI = (("Schülerengagement" OR "student engagement" OR schoolengagement OR "school engagement" OR "time on-task" OR "time off-task" OR "aktive Lernzeit" OR "active learning time" OR Unterrichtsstörungen OR "disruptive behavior" OR "störendes Verhalten" OR beseitigung OR "student involvement" OR involvement OR engagement))) AND TI = ((class OR classroom OR school OR elementary school OR elementary education))	Datum: 01.01.2017 - 15.06.2023, keine Reviews, Englische Texte	1348
	PsycInfo, 1806- und ERIC (via Ovid)	Titel	(student engagement OR school engagement OR time on-task OR time off-task OR active learning time OR disruptive behavior OR student involvement OR involvement OR engagement) AND (elementary school)	Childhood < birth to 12 years > 2017-2023 Englisch	271

C. General student questionnaire.

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Fachhochschule Nordwestschweiz
Pädagogische Hochschule

Pädagogische Hochschule
St.Gallen

Fragebogen für Schülerinnen und Schüler

Klassenteams

Kind ID: _____01

Kompetenzzentrum Forschung, Entwicklung und Beratung Institut Lehr- und Lernforschung
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Fachhochschule Nordwestschweiz
Pädagogische Hochschule

Pädagogische Hochschule
St.Gallen

Liebe Schülerin, lieber Schüler

Gerne möchten wir dich bitten, diesen Fragebogen auszufüllen. Deine Antworten tragen zum Forschungsprojekt *Klassenteams* bei. In diesem Fragebogen geht es um deine Ziele in der Schule und wie du lernst.

Deine Antworten bleiben **anonym**. Am Schluss der Stunde werden alle Fragebogen gleich in ein grosses Kuvert eingepackt. Dieses Kuvert wird direkt zur Forschungsstelle geschickt, niemand anderes sieht deinen Fragebogen.

Die Fragen geben mehrere Antwortmöglichkeiten zum Ankreuzen: Kreuze jenes Kästchen an, das für dich zutrifft oder deiner Meinung am besten entspricht. Es ist wichtig, dass du **alle Fragen** so ehrlich wie möglich beantwortest. Wenn du eine Frage nicht verstehst oder nicht beantworten kannst, frage deine Klassenlehrperson oder mache daneben ein Fragezeichen.

Wir danken dir, dass du diesen Fragebogen sorgfältig und wahrheitsgetreu ausfüllst.

Institut Lehr- und Lernforschung PHSG

Forschungsteam *Klassenteams*

Prof. Dr. Franziska Vogt
Leiterin

M.Sc. Charlotte Corrodi
wissenschaftliche Mitarbeiterin

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_____01

A: Über dich und dein Zuhause

1. Ich bin ein

☐1 Mädchen

☐2 Knabe

2. Wann bist du geboren?

_____ _____ _____

Tag Monat Jahr

3 Wo bist du geboren?

☐1 In der Schweiz

☐2 In einem anderen Land

4. Wie viele Jahre lebst du schon in der Schweiz?

_____ Jahre

5. Wie oft sprichst du zu Hause Deutsch/ Schweizerdeutsch?

☐1 Ich spreche zu Hause immer oder fast immer Deutsch/ Schweizerdeutsch.

☐2 Ich spreche zu Hause manchmal Deutsch/ Schweizerdeutsch und manchmal eine andere Sprache.

☐3 Ich spreche zu Hause niemals Deutsch/ Schweizerdeutsch.

6. Wie sehr treffen die folgenden Dinge deiner Meinung nach auf dich zu? Normalerweise…

		trifft überhaupt nicht zu	trifft nicht zu	trifft eher nicht zu	trifft eher zu	trifft zu	trifft völlig zu
1	… fällt es mir schwer, mich leise zu beschäftigen.	☐1	☐2	☐3	☐4	☐5	☐6
2	… werde ich durch Sachen, die um mich herum passieren, abgelenkt.	☐1	☐2	☐3	☐4	☐5	☐6
3	… bin ich unruhig.	☐1	☐2	☐3	☐4	☐5	☐6
4	… fällt es mir schwer, Dinge zu beenden.	☐1	☐2	☐3	☐4	☐5	☐6
5	… kann ich mich nicht gut konzentrieren.	☐1	☐2	☐3	☐4	☐5	☐6
6	… fällt es mir schwer, still zu sitzen.	☐1	☐2	☐3	☐4	☐5	☐6

_____01

_____01

Einige der folgenden Fragen betreffen deine Mutter und deinen Vater oder die Personen, die wie Mutter oder Vater für dich sind (z.B. Stiefeltern, Pflegeeltern, Vormund).
Falls du in mehr als einer Familie lebst, beantworte die Fragen bitte für diejenigen Personen, mit denen du die meiste Zeit verbringst.

7. Wo ist deine Mutter geboren?

☐1 In der Schweiz

☐2 In einem anderen Land

8. Wo ist dein Vater geboren?

☐1 In der Schweiz

☐2 In einem anderen Land

9. Welchen Beruf übt deine Mutter aus?
(z.B. Verkäuferin, Krankenschwester, Lehrerin)
(Wenn deine Mutter zur Zeit nicht berufstätig ist, gib bitte an, welchen Beruf sie zuletzt ausgeübt hat.)

Beruf*:* _____

10. Welchen Beruf übt dein Vater aus?
(z.B. Schreiner, Automechaniker, Bauingenieur)
(Wenn dein Vater zur Zeit nicht berufstätig ist, gib bitte an, welchen Beruf er zuletzt ausgeübt hat.)

Beruf*:* _____

11. Wie viele Bücher gibt es bei dir ungefähr zu Hause?
Zähle die Zeitschriften und Zeitungen nicht dazu.

☐1 keine oder wenige (0 – 10 Bücher)

☐2 genug, um ein Bücherregal zu füllen (11 – 50 Bücher)

☐3 genug, um ein Büchergestell zu füllen (51 – 200 Bücher)

☐4 genug, um zwei Büchergestelle zu füllen (201 – 400 Bücher)

☐5 genug, um drei Büchergestelle zu füllen (mehr als 400 Bücher)

12. Wie viele Zimmer mit Badewanne oder Dusche gibt es bei dir zu Hause?

☐1 keines (0)

☐2 eines (1)

☐3 zwei (2)

☐4 drei oder mehr (3 oder mehr als 3)

_____01

B: Über dich und deine Klasse

13. Welche Schülerinnen oder Schüler sind deine besten Freunde der Klasse?
Nenne zwischen 0 und 5 Kinder

_____

_____

_____

_____

_____

14. Neben welchen Schülerinnen oder Schülern Deiner Klasse möchtest Du am wenigsten gerne sitzen?
Nenne zwischen 0 und 5 Kinder

_____

_____

_____

_____

_____

15. Es ist mir wichtig, …

		stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme völlig zu
1	…was meine Mitschülerinnen und Mitschüler über mich denken.	☐1	☐2	☐3	☐4	☐5	☐6
2	…was meine Freunde oder Freundinnen in meiner Klasse über mich denken.	☐1	☐2	☐3	☐4	☐5	☐6
3	…was meine Klassenlehrperson über mich denkt.	☐1	☐2	☐3	☐4	☐5	☐6
4	…was meine Lehrperson im Fach Englisch über mich denkt.	☐1	☐2	☐3	☐4	☐5	☐6
5	…was meine Lehrperson im Fach Handarbeit (Textiles Gestalten) über mich denkt.	☐1	☐2	☐3	☐4	☐5	☐6
6	…was meine Eltern über mich denken.	☐1	☐2	☐3	☐4	☐5	☐6

_____01

C: Über das Lernen im Fach Deutsch

16. Dein Interesse am Fach Deutsch

	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme völlig zu
1 Mich interessiert das Fach Deutsch.	☐1	☐2	☐3	☐4	☐5	☐6
2 Ich freue mich auf den Unterricht in Deutsch.	☐1	☐2	☐3	☐4	☐5	☐6
3 Ich habe Spass am Fach Deutsch.	☐1	☐2	☐3	☐4	☐5	☐6

17. Im Fach Deutsch…

	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme völlig zu
1 … denke ich oft an ganz andere Sachen als an das, was wir gerade besprechen.	☐1	☐2	☐3	☐4	☐5	☐6
2 … rede ich bei Gruppenarbeiten meistens über andere Dinge als wir sollten.	☐1	☐2	☐3	☐4	☐5	☐6
3 … beschäftige ich mich oft mit anderen Dingen.	☐1	☐2	☐3	☐4	☐5	☐6

18. Im Fach Deutsch…

	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme völlig zu
1 … war ich schon immer gut.	☐1	☐2	☐3	☐4	☐5	☐6
2 … lerne ich schnell.	☐1	☐2	☐3	☐4	☐5	☐6
3 … bekomme ich gute Noten.	☐1	☐2	☐3	☐4	☐5	☐6

19. Im Fach Deutsch gebe ich mir Mühe, …

	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme völlig zu
1 … weil meine Eltern oder meine Lehrperson von mir erwarten, dass ich mich anstrenge.	☐1	☐2	☐3	☐4	☐5	☐6
2 … damit mich meine Eltern oder meine Lehrperson loben.	☐1	☐2	☐3	☐4	☐5	☐6
3 … weil ich keinen Ärger mit meinen Eltern oder meiner Lehrperson bekommen möchte.	☐1	☐2	☐3	☐4	☐5	☐6

20. Im Fach Deutsch…

	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme völlig zu
1 … ist es bei uns nur selten so ruhig, dass man ungestört mitarbeiten kann.	☐1	☐2	☐3	☐4	☐5	☐6
2 … ist es für die Lehrerpersonen bei uns oft nicht einfach, die Ruhe aufrecht zu erhalten.	☐1	☐2	☐3	☐4	☐5	☐6
3 … stören einige Schüler(innen) immer wieder den Unterricht.	☐1	☐2	☐3	☐4	☐5	☐6

_____01

D: Über das Lernen im Fach Handarbeit (Textiles Gestalten)

21. Dein Interesse am Fach Handarbeit

		stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme völlig zu
1	Mich interessiert das Fach Handarbeit.	☐1	☐2	☐3	☐4	☐5	☐6
2	Ich freue mich auf den Unterricht in Handarbeit.	☐1	☐2	☐3	☐4	☐5	☐6
3	Ich habe Spass am Fach Handarbeit.	☐1	☐2	☐3	☐4	☐5	☐6

22. Im Fach Handarbeit…

		stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme völlig zu
1	… denke ich oft an ganz andere Sachen als an das, was wir gerade besprechen.	☐1	☐2	☐3	☐4	☐5	☐6
2	… rede ich bei Gruppenarbeiten meistens über andere Dinge als wir sollten.	☐1	☐2	☐3	☐4	☐5	☐6
3	… beschäftige ich mich oft mit anderen Dingen.	☐1	☐2	☐3	☐4	☐5	☐6

23. Im Fach Handarbeit…

		stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme völlig zu
1	… war ich schon immer gut.	☐1	☐2	☐3	☐4	☐5	☐6
2	… lerne ich schnell.	☐1	☐2	☐3	☐4	☐5	☐6
3	… bekomme ich gute Noten.	☐1	☐2	☐3	☐4	☐5	☐6

24. Im Fach Handarbeit gebe ich mir Mühe, …

		stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme völlig zu
1	… weil meine Eltern oder meine Lehrperson von mir erwarten, dass ich mich anstrenge.	☐1	☐2	☐3	☐4	☐5	☐6
2	… damit mich meine Eltern oder meine Lehrperson loben.	☐1	☐2	☐3	☐4	☐5	☐6
3	… weil ich keinen Ärger mit meinen Eltern oder meiner Lehrperson bekommen möchte.	☐1	☐2	☐3	☐4	☐5	☐6

25. Im Fach Handarbeit…

		stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme völlig zu
1	… ist es bei uns nur selten so ruhig, dass man ungestört mitarbeiten kann.	☐1	☐2	☐3	☐4	☐5	☐6
2	… ist es für die Lehrerpersonen bei uns oft nicht einfach, die Ruhe aufrecht zu erhalten.	☐1	☐2	☐3	☐4	☐5	☐6
3	… stören einige Schüler(innen) immer wieder den Unterricht.	☐1	☐2	☐3	☐4	☐5	☐6

_____01

E: Über das Lernen im Fach Englisch

26. Dein Interesse am Fach Englisch

	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme völlig zu
1 Mich interessiert das Fach Englisch.	☐1	☐2	☐3	☐4	☐5	☐6
2 Ich freue mich auf den Unterricht in Englisch.	☐1	☐2	☐3	☐4	☐5	☐6
3 Ich habe Spass am Fach Englisch.	☐1	☐2	☐3	☐4	☐5	☐6

27. Im Fach Englisch…

	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme völlig zu
1 … denke ich oft an ganz andere Sachen als an das, was wir gerade besprechen.	☐1	☐2	☐3	☐4	☐5	☐6
2 … rede ich bei Gruppenarbeiten meistens über andere Dinge als wir sollten.	☐1	☐2	☐3	☐4	☐5	☐6
3 … beschäftige ich mich oft mit anderen Dingen.	☐1	☐2	☐3	☐4	☐5	☐6

28. Im Fach Englisch…

	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme völlig zu
1 … war ich schon immer gut.	☐1	☐2	☐3	☐4	☐5	☐6
2 … lerne ich schnell.	☐1	☐2	☐3	☐4	☐5	☐6
3 … bekomme ich gute Noten.	☐1	☐2	☐3	☐4	☐5	☐6

29. Im Fach Englisch gebe ich mir Mühe, …

	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme völlig zu
1 … weil meine Eltern oder meine Lehrperson von mir erwarten, dass ich mich anstrenge.	☐1	☐2	☐3	☐4	☐5	☐6
2 … damit mich meine Eltern oder meine Lehrperson loben.	☐1	☐2	☐3	☐4	☐5	☐6
3 … weil ich keinen Ärger mit meinen Eltern oder meiner Lehrperson bekommen möchte.	☐1	☐2	☐3	☐4	☐5	☐6

30. Im Fach Englisch…

	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme völlig zu
1 … ist es bei uns nur selten so ruhig, dass man ungestört mitarbeiten kann.	☐1	☐2	☐3	☐4	☐5	☐6
2 … ist es für die Lehrerpersonen bei uns oft nicht einfach, die Ruhe aufrecht zu erhalten.	☐1	☐2	☐3	☐4	☐5	☐6
3 … stören einige Schüler(innen) immer wieder den Unterricht.	☐1	☐2	☐3	☐4	☐5	☐6

_____01

F: Über das Lernen im Fach Natur, Mensch, Gesellschaft

31. Dein Interesse am Fach Natur, Mensch, Gesellschaft

		stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme völlig zu
1	Mich interessiert das Fach Natur, Mensch, Gesellschaft.	☐1	☐2	☐3	☐4	☐5	☐6
2	Ich freue mich auf den Unterricht in Natur, Mensch, Gesellschaft.	☐1	☐2	☐3	☐4	☐5	☐6
3	Ich habe Spass am Fach Natur, Mensch, Gesellschaft.	☐1	☐2	☐3	☐4	☐5	☐6

32. Im Fach Natur, Mensch, Gesellschaft…

		stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme völlig zu
1	… denke ich oft an ganz andere Sachen als an das, was wir gerade besprechen.	☐1	☐2	☐3	☐4	☐5	☐6
2	… rede ich bei Gruppenarbeiten meistens über andere Dinge als wir sollten.	☐1	☐2	☐3	☐4	☐5	☐6
3	… beschäftige ich mich oft mit anderen Dingen.	☐1	☐2	☐3	☐4	☐5	☐6

33. Im Fach Natur, Mensch, Gesellschaft…

		stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme völlig zu
1	… war ich schon immer gut.	☐1	☐2	☐3	☐4	☐5	☐6
2	… lerne ich schnell.	☐1	☐2	☐3	☐4	☐5	☐6
3	… bekomme ich gute Noten.	☐1	☐2	☐3	☐4	☐5	☐6

34. Im Fach Natur, Mensch, Gesellschaft gebe ich mir Mühe, …

		stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme völlig zu
1	… weil meine Eltern oder meine Lehrperson von mir erwarten, dass ich mich anstrenge.	☐1	☐2	☐3	☐4	☐5	☐6
2	… damit mich meine Eltern oder meine Lehrperson loben.	☐1	☐2	☐3	☐4	☐5	☐6
3	… weil ich keinen Ärger mit meinen Eltern oder meiner Lehrperson bekommen möchte.	☐1	☐2	☐3	☐4	☐5	☐6

35. Im Fach Natur, Mensch, Gesellschaft…

		stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme völlig zu
1	… ist es bei uns nur selten so ruhig, dass man ungestört mitarbeiten kann.	☐1	☐2	☐3	☐4	☐5	☐6
2	… ist es für die Lehrerpersonen bei uns oft nicht einfach, die Ruhe aufrecht zu erhalten.	☐1	☐2	☐3	☐4	☐5	☐6
3	… stören einige Schüler(innen) immer wieder den Unterricht.	☐1	☐2	☐3	☐4	☐5	☐6

_____01

Vielen Dank für deine Mitarbeit und deine Geduld beim Ausfüllen des Fragebogens!

Einzelne Fragen basieren auf bestehenden Instrumenten, die ausgewählt und teilweise übernommen oder angepasst wurden:

CILS4EU. 2016. Children of Immigrants Longitudinal Survey in Four European Countries. Technical Report. Wave 1 – 2010/2011, v1.2.0. Mannheim: Mannheim University.

Hartmann, B. & Methner, A. (2015). Leipziger Kompetenz-Screening für die Schule – Schülerversion (LKS-S). Ernst Reinhardt, GmbH & Co KG, Verlag, München.

Kovaleva, A., Beierlein, C., Kemper, C. J., & Rammstedt, B. (2014). Internale-Externale-Kontrollüberzeugung-4 (IE-4). Zusammenstellung sozialwissenschaftlicher Items und Skalen. GESIS.

Kovaleva, A., Beierlein, C., Kemper, C. J. & Rammstedt, B. (2012). Eine Kurzskala zur Messung von Impulsivität nach dem UPPS-Ansatz: Die Skala Impulsives-Verhalten-8 (I-8). Zusammenstellung sozialwissenschaftlicher Items und Skalen. GESIS.

Lenski, A. E., Hecht, M., Penk, C., Milles, F., Mezger, M., Heitmann, P., . . . Pant, H. A. (2016). IQB-Ländervergleich 2012.

Lidzba, K., Christiansen, C., & Drechsler, R. (2013). Conners-3: Natur, Mensch, Gesellschafte Adaptation der Conners 3rd Edition.

Neuenschwander, M. P., Goltz, S., Balmer, T., Gasser, A., Hirt, U., Ryser, H., & Wartenweiler, H. (2003). Eltern, Lehrpersonen und Schülerleistungen. Dokumentation des Schülerfragebogens, Stelle für Forschung und Entwicklung, Lehrerinnen-und Lehrerbildung. *Zugriff am*, *29*, 2010.

Neuenschwander, M. P., Böni, E., Holder, M., & Kunz-Makarova, E. (2000). *Schule und Identität im Jugendalter: Kurzdokumentation der Skalen und Stichproben*. Universität Bern, Institut für Pädagogik, Abteilung Pädagogische Psychologie.

Register-Mihalik, J. K., Guskiewicz, K. M., McLeod, T. C. V., Linnan, L. A., Mueller, F. O., & Marshall, S. W. (2013). Knowledge, attitude, and concussion-reporting behaviors among high school athletes: a preliminary study. Journal of athletic training, 48(5), 645-653.

Seidel, T. (2003). Technischer Bericht zur Videostudie" Lehr-Lern-Prozesse im Physikunterricht"; BIQUA: IPN.

_____01

D. Student post-lesson questionnaire

(exemplary for the subject German)

Deutsch

Kompetenzzentrum Forschung, Entwicklung und Beratung Institut Lehr- und Lernforschung
Notkerstrasse 27 CH-9000 St.Gallen +41 (0)71 243 94 80 forschung.sg@phsg.ch www.phsg.ch/forschung

Fachhochschule Nordwestschweiz
Pädagogische Hochschule

PH SG Pädagogische Hochschule St.Gallen

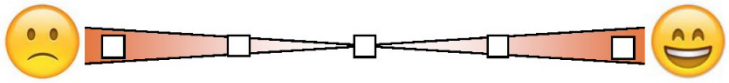
Fragebogen für Schülerinnen und Schüler

Klassenteams - kurz

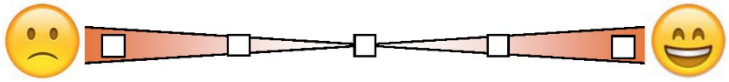
Kind ID: _____01

Kompetenzzentrum Forschung, Entwicklung und Beratung Institut Lehr- und Lernforschung
Notkerstrasse 27 CH-9000 St.Gallen +41 (0)71 243 94 80 forschung.sg@phsg.ch www.phsg.ch/forschung

1. Wie fühlst du dich jetzt gerade? Kreuze an, wie du dich fühlst.



2. Wie hast du dich in dieser Unterrichtsstunde gefühlt?



3. In dieser Unterrichtsstunde…

		stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme völlig zu
1	… fand ich den Unterrichtsstoff schwierig	☐1	☐2	☐3	☐4	☐5	☐6
2	… dachte ich oft an ganz andere Sachen als an das, was wir gerade besprachen.	☐1	☐2	☐3	☐4	☐5	☐6
3	… hatte ich Spass.	☐1	☐2	☐3	☐4	☐5	☐6
4	… fiel es mir schwer, still zu sitzen.	☐1	☐2	☐3	☐4	☐5	☐6
5	… waren mir die wesentlichen Dinge klar.	☐1	☐2	☐3	☐4	☐5	☐6
6	… fiel es mir schwer, Dinge zu beenden.	☐1	☐2	☐3	☐4	☐5	☐6
7	… redete ich meistens über andere Dinge als wir sollten.	☐1	☐2	☐3	☐4	☐5	☐6
8	… behandelten wir ein Thema auf das ich mich freute.	☐1	☐2	☐3	☐4	☐5	☐6
9	…war ich unruhig.	☐1	☐2	☐3	☐4	☐5	☐6

4. In dieser Unterrichtsstunde…

		stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	stimme eher zu	stimme zu	stimme völlig zu
1	… konnte ich mich nicht gut konzentrieren.	☐1	☐2	☐3	☐4	☐5	☐6
2	… hat mich das Thema interessiert.	☐1	☐2	☐3	☐4	☐5	☐6
3	… beschäftigte ich mich oft mit anderen Dingen.	☐1	☐2	☐3	☐4	☐5	☐6
4	…fiel es mir schwer, mich leise zu beschäftigen.	☐1	☐2	☐3	☐4	☐5	☐6
5	…wurde ich durch Sachen, die um mich herum passierten, abgelenkt.	☐1	☐2	☐3	☐4	☐5	☐6
6	... bin ich die ganze Zeit über gut mitgekommen.	☐1	☐2	☐3	☐4	☐5	☐6

Vielen Dank für deine Mitarbeit und deine Geduld beim Ausfüllen des Fragebogens!

Einzelne Fragen basieren auf bestehenden Instrumenten, die ausgewählt und teilweise übernommen oder angepasst wurden:

Betella, A., & Verschure, P. F. (2016). The Affective Slider: A Digital Self-Assessment Scale for the Measurement of Human Emotions. PLoS One, 11(2), e0148037.
Hartmann, B. & Methner, A. (2015). Leipziger Kompetenz-Screening für die Schule – Schülerversion (LKS-S). Ernst Reinhardt, GmbH & Co KG, Verlag, München.
Lidzba, K., Christiansen, C., & Drechsler, R. (2013). Conners-3: Deutsche Adaptation der Conners 3rd Edition.
Neuenschwander, M. P., Goltz, S., Balmer, T., Gasser, A., Hirt, U., Ryser, H., & Wartenweiler, H. (2003). Eltern, Lehrpersonen und Schülerleistungen. Dokumentation des Schülerfragebogens, Stelle für Forschung und Entwicklung, Lehrerinnen-und Lehrerbildung. *Zugriff am*, *29*, 2010.
Seidel, T. (2003). Technischer Bericht zur Videostudie" Lehr-Lern-Prozesse im Physikunterricht"; BIQUA: IPN.

E. Observation manual of the standardized student observation.

PH SG

Inhaltsverzeichnis

Was ist das Projekt «Klassenteams»?

Grundsätzlich fokussiert sich das Projekt auf die Aufmerksamkeit und das Arbeitsverhalten der Schülerinnen und Schüler in verschiedenen Fächern. Es soll erforscht werden, wie hoch die aktive Lernzeit der Lernenden in diesen Fächern ist und wie unterschiedlich diese ist. Ebenfalls interessiert sich das Projekt daran, ob die verschiedenen Lehrpersonen der jeweiligen Fächer zusammenarbeiten und wie dies das Arbeitsverhalten der Schülerinnen und Schüler beeinflusst.

Mehr unter: Fachhochschule Nordwestschweiz (2017). Klassenteams: www.klassenteams.ch

Beobachtung als wissenschaftliche Methode

Im Alltag nehmen wir Beobachtungen gar nicht mehr wirklich wahr, denn sie sind subjektiv. Wir sehen die Welt durch unsere Augen und unsere Meinung wird beeinflusst durch unsere Persönlichkeit. Bei wissenschaftlichem Beobachten soll dies jedoch weitmöglichst vermieden werden. Damit Intersubjektivität geleistet werden kann, wird wissenschaftliche Beobachtung immer zielgerichtet mit einer Methode durchgeführt.

Sowohl Handlungen, sprachliche Äusserungen als auch nonverbales Verhalten werden bei der wissenschaftlichen Beobachtung notiert und kategorisiert durch die bereits erwähnte Methode, sprich, sie ist verhaltensorientiert, da das Verhalten der zu Beobachtenden protokolliert wird.

Mehr unter: Institut für Medien und Bildungstechnologie (imb) (2017). Beobachtungsverfahren. http://qsf.e-learning.imb-uni-augsburg.de/node/526 (06.08.17).

Beobachtungsleitfaden

Vorbereitung

1. Die Akkus von Tablet und Modem laden (Kabel in Beobachtungsset)
2. Batterien der Stoppuhr überprüfen (bei niedrigem Akku erscheint Batteriezeichen rechts unten im Bildschirm).

Ablauf

1. Falls möglich kann sich die beobachtende Person bereits einen Überblick des Klassenzimmers verschaffen. Von Vorteil ist, wenn der- oder diejenige frühzeitig im Schulzimmer erscheint, damit genügend Zeit zur Verfügung steht. Ebenfalls können die benötigten Materialien vorbereitet werden, damit das Verteilen nach Schulbeginn schneller ablaufen kann. Ausführliche Erklärungen zu den einzelnen Geräten befinden sich im Anhang.
    a. Der Intervalltimer wird für das Beobachten vorbereitet («Set», obere Kante Mitte lange drücken). Der Intervalltimer kann am Hosenbund befestigt werden. Siehe «Schwierigkeiten mit Instrumenten» falls Display nicht stimmt.
    b. Das Modem wird gestartet (lange auf Knopf drücken. Modem funktioniert danach auch wenn Bildschirm dunkel ist).
    c. Die Tablets werden aufgestartet und mit dem Modem verbunden. Der Unipark – Fragebogen wird im Webbrowser geöffnet und die erste Seite mit den Angaben zur Beobachtung wird bereits ausgefüllt.
    d. Die Armbinden zur Kennzeichnung der Schülerinnen und Schüler sowie die später zu verteilenden kurzen Fragebögen werden parat gelegt.
    Auf ein kleines Post-it Zettelchen, welches auf das Tablet am oberen Rand geklebt werden kann, wird die Zahl mit der letzten zu beobachtenden Schüler/innen-Nummer geschrieben sowie die Zahlen allfällig abwesender Schüler/innen.

2. Sobald die Schülerinnen und Schüler eingetroffen sind muss sich die beobachtende Person vorstellen und den Kindern erklären, weshalb sie hier ist und was sie während des Unterrichts machen wird, im Sinne von:

    «Guten Morgen, mein Name ist .....Ich bin eine Forscher/in und ich möchte herausfinden, was ihr eigentlich so macht in der Schule. Damit ich Aufschreiben kann was ihr tut, habe ich anstelle eines Heftes ein Tablet – das macht es für mich einfacher, ist aber nichts weiter als eine Art Notizblock. Damit ich euch erkennen

kann, kriegt ihr alle eine Armbinde mit einer Nummer. Ihr kennt diese Armbinden, oder? Beim Fussball hat der Captain immer so eine Binde. Heute seid ihr alle Captains! Ich helfe euch nachher beim Anziehen. Am besten tragt ihr sie über dem Pulli oder dem T-Shirt, ein bisschen oberhalb des Ellbogens, da stört sie euch am wenigsten. Wenn ihr alle die Armbinden habt macht geht euer Unterricht weiter und ihr macht all die Dinge, die ihr sonst auch macht. Ihr tut einfach so, als ob ich gar nicht hier wäre. Zum Schluss habe ich dann noch ein paar Fragen an euch, wie diese Lektion für euch war. Habt ihr noch Fragen dazu?»

3. Um die Schülerinnen und Schüler identifizieren zu können, erhalten sie Armbinden, auf welchen vorne und hinten eine Zahl von 1-28 steht. Die Armbinden werden gemäss Klassenliste verteilt, d.h. die oberste Person auf der Liste erhält das Leibchen mit Nummer eins, etc. Die Beobachtenden helfen den Kindern beim Anziehen der Armbinden. Für die Kinder ist es am bequemsten, wenn die Armbinden über das T-Shirt oder den Pullover leicht oberhalb des Ellbogens befestigt werden.
   Die Armbinden sind verschieden farbig:
   1-5: blau
   6-10: rot
   11-15: gelb
   16-20: grün
   21-28: weiss

4. Sobald die Schülerinnen und Schüler ihre Armbinden angezogen haben, platziert sich die beobachtende Person so, dass sich möglichst alle Kinder in ihrem Blickfeld befinden. Der Intervalltimer wird gestartet («Start», linke Seitenkante) und die Beobachtungen beginnen.
   (Sind zwei Beobachtende in der Unterrichtsstunde, starten sie ihre Timers gleichzeitig und stehen nebeneinander. Jeweils nach 5 Beobachtungen stellen sie kurz sicher, dass sie sich bei der Beobachtung des gleichen Kindes befinden.)
   Die Beobachtungen finden der Reihe nach statt, sprich es wird zuerst Kind 1 beobachtet, dann Kind 2, etc. bis zur letzten Nummer. Dann wird wieder von vorne begonnen. Wichtig ist, dass immer nur ein Kind aufs Mal beobachtet wird. Findet die beobachtende Person das der aktuellen Zahl entsprechende Kind nicht, lässt sie oder er das Formular leer und geht bei der nächsten Beobachtung weiter zum nächsten Kind.
   Das Zeitintervall jeder Beobachtung beträgt 15 Sekunden; dann wird das zu beobachtende Kind gewechselt. Der Intervalltimer vibriert alle 15 Sekunden. Die Vibration kennzeichnet den Zeitpunkt der Beobachtung des Kindes: Wenn der

3

Intervalltimer vibriert entscheidet die Beobachterin/ der Beobachter auf einen Blick, um welche Kategorie des Verhalten es sich handelt und notiert das im Unipark Formular. D.h. die erste Kategorie, in die das Verhalten des Schülers/der Schülerin in diesem einen Moment fällt wird ausgewählt, auch wenn er/sie z.B. 5 Sekunden danach ein anderes Verhalten zeigt.

5. Die Beobachtungsbogen sind in verschiedene Sets unterteilt (A, B, C usw.). Sind alle Kinder das erste Mal beobachtet worden, d.h. die der Klassengrösse entsprechende Anzahl wurde erreicht, wird im Dropdown- Menu das zweite Set angewählt. Das nächste Beobachtungsformular muss nun 1-B heissen. Sind alle Kinder im Set B durch (2-B, 3-B...), wird das Formular 1-C angewählt usw. Für diesen Wechsel der Sets kann ein 15-Sekunden-Intervall übersprungen werden.
6. Nach ca. 40 Minuten endet die Beobachtung und die Kinder erhalten einen kurzen Fragebogen (siehe Instruktion Fragebogen).
7. Danach werden Fragebogen und Armbinden eingesammelt und die beobachtende Person verabschiedet sich von der Klasse.

Abschluss

1. Auf dem Tablet im Dropdown-Menu zur Endseite gehen und die Beobachtung beenden.
2. Tablet ausschalten (Knopf obere Kante links, „Ausschalten" wählen, „Ok" wählen).
3. Modem ausschalten (Knopf lange drücken).
4. Timer ausschalten (lange auf „Set", obere Kante Mitte, drücken).

Materialliste

- Tablet: Samsung GALAXY Tab 10.1 GT-P7510 (inkl. Ladekabel + Stecker)
- Modem: Huawei LTE Hotspot E5577Cs-603, weiss (inkl. Ladekabel)

- Intervalltimer: Gymboss® Intervall Timer (inkl. AAA-Ersatzbatterien)

- Kugelschreiber
- Kleine Post-it Zettel
- Armbinden mit Nummern
- Ausdruck Fragebogen, falls das Internet nicht funktioniert
- (Kurzer Fragebogen)

5

Erfassungsinstrument auf dem Tablet

Zur Erfassung der Verhaltensweisen der Schülerinnen und Schüler wurde eine Eingabemaske (analog zu einem Fragebogen) mit dem online Fragebogentool Unipark erstellt. Um den Fragebogen zu öffnen ist eine Internetverbindung notwendig.

Der Fragebogen ist über folgenden Link: https://ww2.unipark.de/uc/IFE/6e96/ beziehungsweise folgenden QR Code abrufbar:

Wird mit dem Öffnen des Webbrowsers der Fragebogen nicht oder nicht richtig angezeigt, siehe «Schwierigkeiten mit Instrumenten».

Wenn nun der Fragebogen geöffnet wurde, können auf der ersten Seite Informationen eingetragen werden, welche es erlauben die getätigte Beobachtung zu einem späteren Zeitpunkt wieder zu identifizieren. Beim Kommentar kann z.B. aufgeschrieben werden, ob ein Kind abwesend war.

Oben im Browser befindet sich eine Leiste mit einem Dropdown-Menu, durch welches man zu anderen Seiten springen kann (z.B. von der Beobachtung des ersten Kindes zum vierten und wieder zurück).

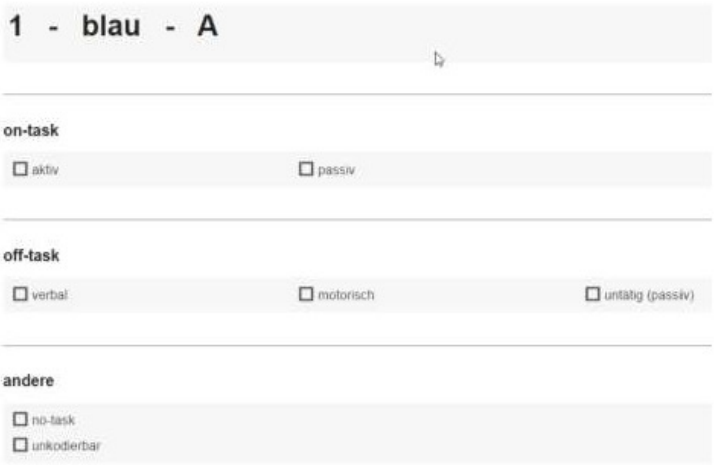
Dieses Feature kann genutzt werden, falls es weniger als 28 Kinder in einer Klasse hat, um nach dem letzten Kind wieder zur Beobachtung von Kind 1 zu gelangen. Auf Set A folgt Set B usw., , somit wird vom letzten Kind im ersten Set (z.B. 24 –A) zum Kind 1 im nächsten Set (1-B) gewechselt.

Zudem ist kann es genutzt werden, falls nicht alle Beobachtungsseiten während der Beobachtungsdauer genutzt werden. So kann zur letzten Seite gesprungen werden, auf der es die Möglichkeit gibt nochmals Kommentare zur Beobachtung hinzuschreiben.

Am Ende der Beobachtung geht man zur Seite «Abschluss», falls nochmals ein Kommentar zur Beobachtung hinterlegt werden muss. Anschliessend begibt man sich zur «Endseite».

Nachdem die Startseite mit den benötigten Informationen ausgefüllt wurde, kann auf «weiter» geklickt werden, wodurch man zur ersten Beobachtungsseite geleitet wird.

Die Nummer des zu beobachtenden Kindes sowie die Farbe seiner Armbinde und Beobachtungsrunde (A-J) sind bereits auf der Seite vermerkt (z.B. 1 - blau - A). Darunter gibt es mehrere Optionen, um das Verhalten des Kindes zu kategorisieren (siehe Graphik). Diese werden im folgenden Abschnitt beschrieben.



7

Beschreibung Verhaltenskategorien

On-task

Das Verhalten des Kindes ist als «on-task» zu kategorisieren, wenn es das von der Lehrperson gewünschte Verhalten zeigt. Hier wird im Fragebogen lediglich zwischen aktiv und passiv unterschieden. *Passiv* wird das on-task Verhalten bezeichnet, wenn das Kind der Lehrperson oder dem Kind, welches etwas sagen/ zeigen soll, passiv zuhört/ zuschaut. Alle anderen on-task Verhaltensweisen werden mit aktiv gekennzeichnet.

Beispiele für *aktives* on-task Verhalten:

- Aufstrecken
- Zur LP gehen, warten um eine Frage zu stellen
- Aufsätze / Aufgaben am Computer lösen
- Zu verschiedenen Atelierposten gehen, um eine Arbeit auszusuchen
- Blätter weitergeben, wenn von LP gefordert
- Bei Sing- und Bewegungsspielen mitmachen
- Taschenrechner und andere Hilfsmittel benützen
- Hefte, Bücher, Schreibzeug und andere Hilfsmittel hervor nehmen und bereitstellen
- Bücher und Hefte aufschlagen
- Abschreiben, Schreiben, Malen, … wenn von LP erwartet
- Antworten, wenn LP fragt
- Bei Gesprächen, die relevant sind, mitreden (auch in GA oder PA)
- Laut denken
- Lachen, wenn die LP einen Witz macht
- Lautes Vorlesen
- Mit LP oder SuS über relevante Dingen sprechen
- Stilles Lesen von beauftragter Literatur

Beispiele für *passives on-task* Verhalten:

- Anderen SuS beim Fragen beantworten zuhören
- Einer Geschichte/Erklärungen zuhören
- andere Sus bei der Arbeit beobachten
- In Schlange stehen

Falls ein Kind den Blick zur Lehrperson/ der Wandtafel bzw. dem Ort des Unterrichtsgeschehens hat und dem Anschein nach dem Unterricht passiv folgt, aber gleichzeitig z.B. mit den Haaren herumzappelt, so wird das Verhalten als passiv on-task bewertet. Sobald jedoch die Blickrichtung des Kindes nicht zum Unterrichtsgeschehen hingerichtet ist, so würde dieses Verhalten als motorisch off-task bewertet werden.

Off-task

Das Verhalten des Kindes wird als «off task» bezeichnet, wenn es nicht von der Lehrperson erwünscht ist. Im Fragebogen wird dies durch drei Unterkategorien unterschieden.

Verbal: Jegliches Verhalten, dass sich verbal äussert. Beispiele:

- Unangebrachte Geräusche machen (Pfeifen, singen, vor sich hinreden.)
- Mit anderen Schülerinnen und Schülern schwatzen
- Nicht angebrachte Kommentare geben
- Dreinreden/ Laut antworten, wenn nicht erlaubt

Motorisch: Jegliches Verhalten, bei dem sich das Kind unaufgefordert oder unerwünscht störend bewegt. Beispiele:

- Mit dem Stuhl oder Pult spielen (schaukeln, drehen, hoch- und herunterlassen)
- Sinnlos im Buch herum blättern
- Mit Dingen spielen (mit Büroklammer spielen, Papier und Gummis herumwerfen, mit dem Stift spielen oder daran herum kauen, Papier falten und zerknüllen)
- Andere SuS anstossen/ berühren, wenn nicht erwünscht
- Mit eigenen Körper/ Kleider spielen (Nägel kauen, mit Haaren spielen)

Untätig (passiv): Jegliches Verhalten, bei dem das Kind weder verbal noch motorisch störend auffällt, jedoch trotzdem nicht dem Unterricht folgt. Beispiele:

- Sitzt nur herum ohne etwas zu tun
- Im Klassenzimmer herumschauen, zum Fenster hinausschauen
- Störendem Verhalten anderer SuS zuhören/zuschauen
- Tagträumen, schlafen oder dösen

Andere:

No-task

Das Verhalten ist als «no-task» zu verstehen, wenn die Lehrperson keine Verhaltensvorgaben gemacht hat. Beispiel: Die Lehrperson erhält einen Telefonanruf mitten im Unterricht, hebt ab und telefoniert ohne den Kindern vorher eine Anweisung gegeben zu haben.

Unkodierbar

Das Verhalten eines Kindes ist unkodierbar, wenn es zu keiner der anderen Kategorien gehört

Weiter

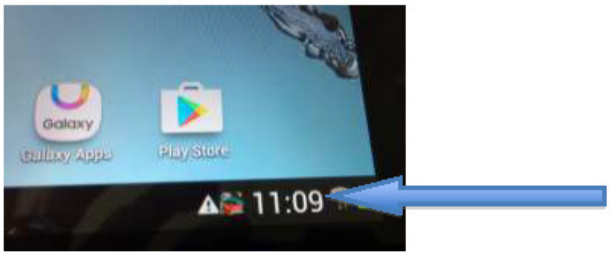
Der «Weiter»-Knopf wird angeklickt, wenn die Beobachtungen eingetragen sind und das nächste Kind beobachtet wird. «Weiter» wird ebenfalls gedrückt, wenn das Kind 9

nicht im Blickfeld der zu beobachtenden Person war während des Zeitintervalls. Dies kann geschehen, wenn das Kind gerade nicht im Raum ist oder weil der Beobachter/die Beobachterin das Kind nicht findet. Mit «Weiter» wird diese Beobachtung übersprungen und der Rhythmus der Intervalle beibehalten.

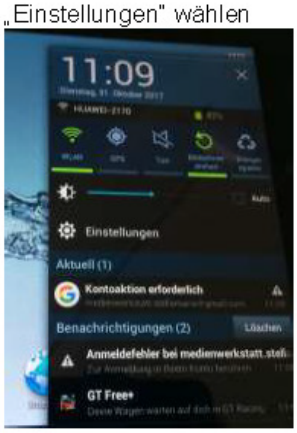
Schwierigkeiten mit Instrumenten

1. **Tablet macht keine Verbindung zu Internet**
   Lässt sich der Fragebogen auf dem Tablet nicht öffnen, muss zuerst herausgefunden werden, ob das Tablet die Verbindung zum Modem aufnehmen konnte. Das Aufnehmen dieser Verbindung dauert manchmal etwas länger. Falls die Verbindung nach einer Weile nicht zu Stande kommt bitte folgende Schritte ausführen:

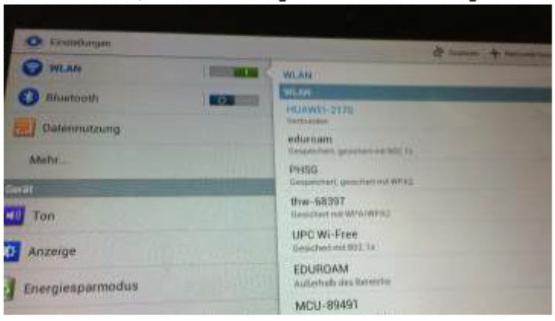
   a) Unten rechts auf das WLAN Zeichen drücken



   b) „Einstellungen" wählen



   c) Kontrollieren, ob richtiges WLAN angewählt wurde (HUAWEI-2170)



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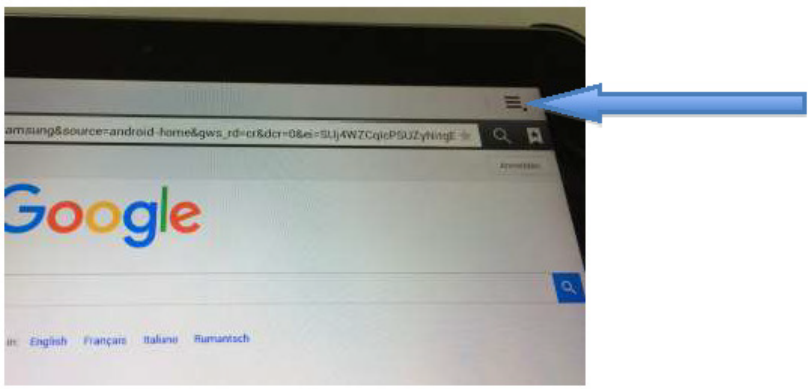
d) Falls das Passwort für das WLAN fehlt, kann es dem Display des Modems entnommen werden.

WLAN-Verbindung sollte nun möglich sein.

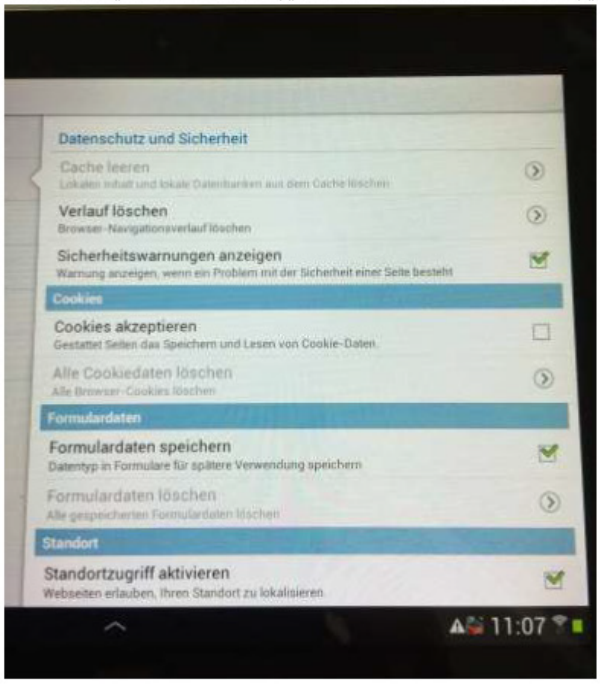
2. **Neuer Fragebogen erscheint nicht, bzw. Ende der letzten Beobachtung erscheint**
   Nach einer durchgeführten Beobachtung müssen alle alten Daten aus dem Internet-Browser gelöscht werden, damit das neue Formular aufgestartet werden kann:

   a) Internet Browser öffnen

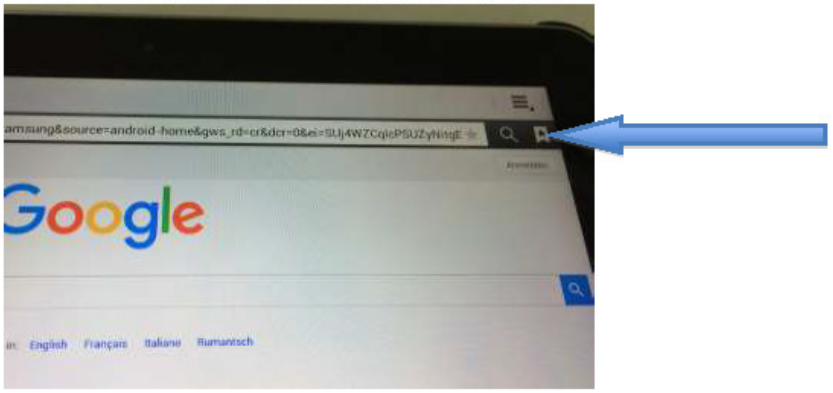
   b) Oben rechts Strich-Symbol anklicken



c) Wähle „Einstellungen", „Datenschutz und Sicherheit"
d) Klicke auf „Cache leeren", „alle Cookiedaten löschen", „Formulardaten löschen"



e) Zurück zum Browser-Fenster, Buchzeichen anklicken

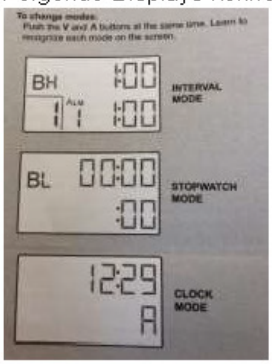


Die Umfrage sollte nun angewählt werden können oder als link eingetippt werden.

3. Timer hat keine Programmierung mehr
Bei richtiger Programmierung erscheint Folgendes auf dem Display des Timers:

Beim Auswechseln der Batterien könnte die Programmierung verloren gehen. Um die Programmierung wieder einzurichten müssen folgende Schritte befolgt werden:

a) Beide Pfeiltasten gleichzeitig drücken
b) Folgende Displays können nun angewählt werden:



c) «Interval Mode» wählen
d) «Set»
e) Mit Pfeilen oberes Intervall auf 0:15 stellen
f) «Set»
g) Unteres Intervall auf 0:15 stellen
h) «Set»
i) Mit Pfeilen Anzahl Wiederholungen auf 99 setzen
j) «Set»
k) «V» auswählen
l) «Set»
m) ALM (Alarm) auf 1 sec.
n) «Set»

4. Batterie-Zeichen erscheint auf Display des Timers

Erscheint das Batterie-Zeichen im Display des Timers, ist die Batterie bald zu Ende und muss ausgewechselt werden. Im Beobachtungsset befinden sich Ersatzbatterien.

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5. **Display des Timers reagiert nicht mehr**
   Falls das Display des Timers nicht mehr reagiert, bitte neue Batterien einsetzen. Für einen Reboot mit Bleistift-Spitze Reboot-Knopf an rechter Kante drücken.

6. **Tablets neu einrichten**
   a) In den Einstellungen unter "Sichern und Zurücksetzen" im Abschnitt "Persönliche Informationen" den Punkt "Auf Werkseinstellungen zurücksetzen» auswählen. Dann unten «Gerät zurücks.» auswählen und im nächsten Fenster mit «Alle löschen» bestätigen.
   b) Tablet startet neu. Aufsetzungsprozess startet. Warten bis das «Willkommen» Fenster erscheint. Kontrollieren, dass «Deutsch (Schweiz)» steht und dann «Starten» klicken.
   c) WLAN einrichten. Beispiel: An der PHSG wählt man das «PHSG» WLAN und gibt dann das aktuelle Passwort (siehe Extranet) ein, klickt verbinden und wartet bis unter dem nun mit hellblauer Schrift stehenden WLAN Name «Verbunden» steht. Dann klickt man auf den «Weiter» Button.
   d) Datum und Uhrzeit mit den Pfeiltasten korrigieren. Dann den «Weiter» Button klicken.
   e) Den «Anmelden» Button klicken. Folgende Daten eingeben:
   E-Mail: kokeastablet
   Passwort: klassenteams
   Dann «Anmelden» klicken und warten bis Anmeldung vor sich gegangen ist.
   f) «Überspringen» klicken.
   g) Beide Häkchen setzen und «Weiter» klicken.
   h) Auf der Seite «Google-Standort verwenden» Häkchen entfernen und dann «Weiter» klicken.
   i) «Weiter» klicken.
   j) «Beenden» klicken. Der Aufsetzungsprozess ist damit beendet.
   k) Als nächstes wird auf dem Home-Bildschirm (darauf gelangt man automatisch, bzw. wenn man auf das Häuschen-Symbol links unten klickt) alles ausser der App «Internet gelöscht. Dazu klickt man lange auf ein Feld bzw. ein App-Symbol und zieht es dann nach rechts oben auf das Feld «Löschen».
   l) Jetzt drückt man in der schwarzen Menu-Leiste am unteren Rand auf die Uhrzeit. Dadurch klappt unten rechts ein Rechteck auf. In diesem Rechteck drückt man auf die «Einstellungen». Die nächsten Punkte beziehen sich auf Dinge, die unter verschiedenen Punkten in den Einstellungen geändert werden müssen.
   m) Beim Punkt «Ton» klickt man auf «Lautstärke». Im aufgepoppten Fenster drückt man bei allen drei Lautstärke-Kontinuen auf den tiefsten Punkt (ganz links im Kontinuum). Danach klickt man «OK».
   n) Immer noch beim Punkt «Ton» klickt man auf «Vibrationsintensität» und setzt auch hier beide Kontinuen auf den tiefsten Punkt. Danach klickt man «OK».
   o) Weiter im Punkt «Ton» entfernt man alle Häkchen.

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p) Als nächstes geht man zum Punkt «Anzeige». Jetzt hält man das Tablet so in der Hand, dass es sich im Portrait Modus befindet (die kurzen Seiten sind oben und unten). Während man das Tablet so in der Hand hält, entfernt man das Häkchen bei «Bildschirm automatisch drehen».
q) Weiter im Punkt «Anzeige» drückt man auf den Punkt «Schnellstart» und wählt im aufpoppenden Menu «Ohne».
r) Weiter im Punkt «Anzeige» wählt man «Bildschirm-Timeout». Im aufpoppenden Menu wählt man das unterste Feld «Nach 30 Minuten Inaktivität».
s) Als nächstes geht man in den Einstellungen zum Punkt «Standortdienste». Dort entfernt man alle Häkchen.
t) Jetzt kann man zurück auf den Homebildschirm gehen (indem man das Häuschen-Symbol drückt).
u) Hier wählt man das App-Symbol «Internet» aus. Danach öffnet sich ein Internet Browser. Oben in der Suchleiste gibt man die Adresse des Fragebogens ein und klickt danach auf «Los». Die Fragebogen Adresse ist die folgende: https://ww2.unipark.de/uc/IFE/6e96/
v) Darauf öffnet sich die Webseite mit dem Fragebogen. Diese kann man nun als Lesezeichen speichern indem man auf das Sternchen in der Suchleiste klickt. Im darauf aufgepoppten Fenster schreibt man im Feld «Name» das Wort «Fragebogen» und klickt dann auf «OK».
w) Als nächstes klickt man ganz oben rechts auf die drei Linien (Browsermenu) und wählt dann «Einstellungen». In den Einstellungen klickt man auf «Startseite festlegen» und wählt dann «Leere Seite». Zudem entfernt man das Häkchen bei «Formulare automatisch ausfüllen».
x) Dann klickt man oben auf den Linkspfeil um wieder zurück in den Browser zu kommen.
y) Jetzt klickt man auf das Lesezeichen Symbol rechts oben (ein Wimpel mit einem Stern in der Mitte, unter dem Menu Symbol). Im aufpoppenden Fenster klickt man lange auf das Symbol des «Yahoo!» Lesezeichens und wählt dann «Lesezeichen löschen».
z) Mit dem Linkspfeil links oben kommt man wieder zurück in den Browser. Nun ist alles getan und das Tablet sollte wieder wie gewünscht eingerichtet sein. Es kann mit oben beschriebenem Ablauf weitergemacht werden.

7. Es ist kein Mobiltelefonnetz bzw. kein Internet über das Mobiltelefonnetz vorhanden.

In diesem Fall muss man die Beobachtungen im Papierausdruck rapportieren. Das Vorgehen ist analog zur Eingabe im Unipark Online Fragebogen.

Auf der ersten Seite sind von der beobachtenden Person genau dieselben Fragen zu beantworten wie im Online Fragebogen Formular.

Danach entspricht jeweils ein Beobachtungsset einer Seite (siehe Abbildung unten für Set B).

B

Kind	on-task		off-task			andere	
	aktiv	passiv	verbal	motorisch	untätig (passiv)	no-task	unkodierbar
1	☐	☐	☐	☐	☐	☐	☐
2	☐	☐	☐	☐	☐	☐	☐
3	☐	☐	☐	☐	☐	☐	☐
4	☐	☐	☐	☐	☐	☐	☐
5	☐	☐	☐	☐	☐	☐	☐
6	☐	☐	☐	☐	☐	☐	☐
7	☐	☐	☐	☐	☐	☐	☐
8	☐	☐	☐	☐	☐	☐	☐
9	☐	☐	☐	☐	☐	☐	☐
10	☐	☐	☐	☐	☐	☐	☐
11	☐	☐	☐	☐	☐	☐	☐
12	☐	☐	☐	☐	☐	☐	☐
13	☐	☐	☐	☐	☐	☐	☐
14	☐	☐	☐	☐	☐	☐	☐
15	☐	☐	☐	☐	☐	☐	☐
16	☐	☐	☐	☐	☐	☐	☐
17	☐	☐	☐	☐	☐	☐	☐
18	☐	☐	☐	☐	☐	☐	☐
19	☐	☐	☐	☐	☐	☐	☐
20	☐	☐	☐	☐	☐	☐	☐
21	☐	☐	☐	☐	☐	☐	☐
22	☐	☐	☐	☐	☐	☐	☐
23	☐	☐	☐	☐	☐	☐	☐
24	☐	☐	☐	☐	☐	☐	☐
25	☐	☐	☐	☐	☐	☐	☐
26	☐	☐	☐	☐	☐	☐	☐
27	☐	☐	☐	☐	☐	☐	☐
28	☐	☐	☐	☐	☐	☐	☐

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F. Curriculum Vitae

Curriculum Vitae

Charlotte Báez (née Corrodi)
Scientific collaborator
Lecturer

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www.baez.ch

Professional Interests

Self- and social regulation of student engagement
Teacher collaboration
Digitalization in elementary school
Scientific research methods / research data management

Education

2018 – 2024	Doctor of Philosophy in Educational Sciences, Institute for Educational Sciences, University of Basel, Prof. Dr. Markus Neuenschwander, Prof. Dr. Elena Makarova und Prof. Dr. Franziska Vogt
2023	CAS Digital Learning, Zurich Universities of Applied Sciences and Arts
2017 – 2018	CAS Higher & Professional Education, Zurich Universities of Applied Sciences and Arts
2013 – 2015	Master of Science in Psychology, University of Geneva
2010 – 2013	Bachelor of Science in Psychology, University of Basel
2008 – 2009	Human Movement Sciences and Sport, ETH Zürich

further professional training by topic:

Communi-cation and teaching	2023 Certified Peer Reviewer Course, Elsevier Researcher Academy 2023 Media production and media design, PHSG 2021 Media and presentation training, University of Basel 2021 Scientific Publishing, PHSG 2020 Writing for Research in Educational Sciences, University of Basel 2020 Use of evaluation results, PHSG 2018 Speaking more freely: planned, spontaneous & precise formulation, University of Basel 2018 Rhetoric - performing confidently and convincingly in front of an audience, EB Zürich 2018 Voice training, VHS Zürich 2017 Design of student-activating courses, PHSG
Leadership and project management	2021 Successful Team Leadership, University of Basel 2021 Conversation management in teaching and leadership, PHSG 2018 From DMP's to data sharing in the Humanities and Social Sciences, University of Basel 2015 Project Management for PhD Students, ETHZ 2006 J+S Leadership course Orienteering 2004 J+S Leadership course Camp sports/ trekking

Research methods	2023 Analyzing classroom interactions, University of Groningen 2023 Design and analysis of longitudinal studies, University of Basel 2021 Mediation and moderation analyses in structural equation modeling in R, University of Cologne, PHSG and Paris Lodron University of Salzburg 2019 Latent Profile Analysis & Latent Transition Analysis, University of Bern 2019 Systematic literature review, University of Basel 2017 Multilevel Structural Equation Modeling, FORS 2017 Statistical Analysis of Social Networks with ERGMs, USI Lugano 2016 Metascience, ETHZ 2015 SIENA Winter school on Longitudinal Social Network Analysis, ETHZ 2015 Doing Research with SNA: Tools, Theories, and Applications, University of Greenwich 2015 Introduction to R and RStudio, GESIS 2015 Statistical Modelling of Spatial Data, ETHZ

Employment

Since 2018	Researcher and lecturer, PHSG Since 2022 Scientific collaborator at the Institute of digital and computer science education Since 2021 Coordinator of a large scale evaluation for a school development project (Accompanying evaluation in sub-project 1a model schools of the IT education offensive in the canton of Sankt Gallen) Since 2020 Scientific collaborator at the center for science support Since 2018 Lecturer in Educational Psychology and Scientific Research Methods in multiple degree programs (Kindergarten und Primarstufe, Sekundarstufe I, Master Early Childhood Studies) 2017-2022 Scientific collaborator at the Institute for Research into Teaching and Learning
2015 – 2019	Property management Brunnenbergstrasse 12, St.Gallen
2015 – 2016	Research fellow, Chair for social networks at ETH Zurich
2014 – 2015	Scientific assistant, Chair for social psychology at the University of Geneva
2014 – 2015	Research intern, Center for social psychology, University of Basel
2013	Nursing staff for people with psychological impairments, Residential home Pegasus Basel
2012 – 2013	Security service employee, Securitas AG Basel
2012	Psychological intern in the psychosomatic clinic, SIGMA Zentrum
2010	Barista, Starbucks Coffee Switzerland AG
2008 – 2010	Security service and sales / customer service employee, Securitas AG St. Gallen

Professional service

Committee work	Since 2023 JURE Coordinator for EARLI SIG 10 Social Interaction in Learning and Instruction 2014–2015 Vice-President of the Umbrella Association of Swiss Psychology Students 2014 Head of Congress of the Swiss National Congress for Psychology Students, 11th Edition, Därstetten (CH), 21/03/2014 – 23/03/2014, hosting around 120 Participants, 3 Keynotes, 4 Lectures, 14 Workshops und 10 Student Lectures 2012–2015 Webmaster for the Umbrella Association of Swiss Psychology Students
Review activities	American Educational Research Association (AERA) SIG-Motivation in Education Journal Learning and Instruction

Membership of professional networks	American Educational Research Association (AERA) Division C Learning & Instruction SIG Motivation in Education European Association for Research on Learning and Instruction (EARLI) EARLI SIG 8 Motivation and Emotion EARLI SIG 10 Social Interaction in Learning and Instruction Schweizerische Gesellschaft für Lehrerinnen- und Lehrerbildung (SGL) SGL task force Forschung in der Lehre Schweizerische Gesellschaft für Bildungsforschung (SGBF) SGBF task force Profession enseignante et professionnalisation de la formation R Ladies Switzerland NaWik-Netzwerk für kommunizierende Forschende

Projects

Since 2022	Research project Collaborating throughout the digital transformation (Zusammenarbeit(en) in der digitalen Transformation), https://www.phsg.ch/de/zusammenarbeiten-der-digitalen-transformation
Since 2021	Coordinator for a large scale evaluation for a school development project (Evaluation im Teilprojekt 1a Modellschulen Volksschule der IT-Bildungsoffensive im Kanton Sankt Gallen, https://itbo-modellschulen-vs.notion.site/4-Begleitevaluation-63e8c2e331dd44d5a21dcf5001145194)
2022 – 2023	WEFO project ‘Zentrum Wissenschaftsberatung’
2021 – 2023	Strategy project ‘Neuentwicklung Modul Lernen’
2020 – 2022	Strategy project ‘Projektorientiertes Datenmanagement’
2017 – 2021	Research project ‘Kooperation von Klassenteams und deren Effekte auf die aktive Lernzeit von Schülerinnen und Schülern (Klassenteams)’, www.klassenteams.ch

Awards

2012	Best Poster Award, Tagung experimentell arbeitender Studierenden, University of Basel
2005	Swiss Young Physics Talent, Invitation to the Physics Young Ambassandors Symposium in Taipei, Taiwan

Separate Document
Publications