



Pupils' Perception of the Learning Environment and Well-being: A Validation Study of The Norwegian Pupil Survey

Ebenezer Kwame Kyereh

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Popular Abstract

The Pupil Survey allows for pupils' views on issues that matter for their learning and well-being at school. The results from the survey then inform teachers, principals/management, local and central authorities of the Norwegian education system about learning and well-being. Inherent in the use of the survey results is a claim of association between the learning environment and well-being. However, such a claim requires justification in the form of scientific evidence to ensure proper use and interpretation of results from the survey. The present study contributes to the accumulation of such evidence by testing the associations between the learning environment and well-being based on theory using measures from the Pupil Survey. The study finds evidence of such associations as proposed in theory within the context of the Pupil Survey. This finding to some extent justifies the continuous use of the survey results for the intended purpose of informing actors in the Norwegian education system about learning and well-being.

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Abstract

The Pupil Survey primarily measures learning environment and outcomes of the school setting from pupils' perspective. The survey results which play integral role in the Norwegian national assurance system inform actors in the education sector about learning and well-being at school. This use of the survey results assumes association between the learning environment and well-being. Therefore, within the context of concurrent criterion associations validity evidence, the present study contributes to the validation of the intended use and interpretation of the survey results by testing a model of theoretically derived hypotheses about the relations between aspects of the learning environment and well-being. The study applies a two-step structural equation modelling (SEM) to a sample of 12,241 pupils (comprising 50.4% boys and 49.6% girls) in tenth grade who participated in the 2020 round of the Norwegian Pupil Survey. The results show that, in general, the survey measures included in the present study have acceptable psychometric properties. In addition, aspects of the learning environment as measured in the survey share positive associations with well-being in accordance with theory, and further explain appreciable variations in the criterion.

Keywords: pupil survey, learning environment, well-being, validation

**Pupils' Perception of the Learning Environment and Well-being: A Validation
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The quality of the learning environment matters to a gamut of actors and stakeholders in an education system – pupils, parents, teachers, principals/management, local and central authorities. This concern largely derives from the observation that children spend considerable amount of time in school (OECD, 2017) and that the quality of the academic, community, safety and institutional environments has implications for their well-being (Wang et al., 2020; Wang & Degol, 2016). It is with this understanding that the Norwegian government through the Directorate for Education and Training conducts *The Pupil Survey* annually to give voice to pupils about learning and well-being. The directorate considers the Pupil Survey as an integral part of the national quality assurance system in the form of provision of information to key players in the education system (Wendelborg et. al., 2012).

The survey strings various aspects of the learning environment measured from pupils' perspective such as support from teachers, home support and safe school environment as well as student psychological outcomes such as well-being. The intention is to elicit responses from pupils to inform stakeholders of the education system about learning and well-being at school. Inherent in this reasoning is a claim of association between the learning environment and well-being. Whilst this assumption is amenable to theory and empirical evidence (Newland et al., 2019a, 2019b; OECD, 2017; Reid & Smith, 2018; Wang et al., 2020; Wang & Degol, 2016), there is limited study in the Norwegian context by way of validity evidence in respect of use of the results of the Pupil Survey to inform about learning and well-being at school.

The most recent study on the Pupil Survey examined aspects of the learning environment – students perception of teacher support, numeracy and assessment for learning – and their relations with motivational responses and mastery experiences based on specified

theoretical models (Federici et al., 2016). The previous study focused on domains of the learning environment that typically relate to the classroom situation and student academic outcomes. The present study extends the domain to the broader setting of learning whilst focusing on pupils' psychological outcome (well-being). This is particularly important given that *The Education Act 1998* accentuates pupils' right to good school environment conducive to health, well-being and learning (s. 9A-2).

In addition, over the years, the documentation of the quality of the Pupil Survey has mainly and naturally occurred as part of primary analyses in the form of annual reports on the analyses of the indices in the survey (Wendelborg et. al., 2012; Wendelborg et. al, 2014; Wendelborg et. al., 2016; Wendelborg, 2021). Whilst there are allusions to measurement properties of the measures in the survey, such reports have centred on the analyses of the survey results pursuant to thematic areas determined in consultation with the Directorate of Education, the implementing agency (Wendelborg, 2021).

Although the Pupil Survey since the last revision in 2012 has undergone both exploratory (EFA) and confirmatory factor analyses (CFA) as well as analyses of face validity and discriminant or convergence validity (Federici & Wendelborg, 2015; Wendelborg et al., 2015), validity is not a permanent property. It requires a continuing process (validation) in which various sources of validity evidence are collected to put up an argument for the intended interpretation and use of the results from the survey (Hughes, 2018). Moreover, "there is no single definition of validity, nor is it established in a single study" (Kline, 2016, p. 93). This is particularly necessary given that there are some features of the measures in the survey that have implications for measurement quality. For example, well-being and motivation scales combine items with different response categories. The underlying order extends across quantity, frequency or degree of the latent factor. While earlier studies (Wendelborg et. al., 2014; Wendelborg et al., 2015) argue they function as a

scale, the composition may potentially hurt the quality of the measures. There is also the problem of a single-item scale given that single items may give important but limited information about a concept (Olsen, 2004). Even though the well-being scale originally comprise five items in the survey, the reports on analyses consider only the global item, “Do you enjoy being at school?”. This poses limitations to reliability and factor analyses as admitted in the 2020 report (Wendelborg, 2021).

In the light of the foregoing discussion, it is worthwhile to add to the documentation of the quality of the Pupil Survey. The present study therefore contributes to this process in the form of a concurrent criterion validity evidence by testing a model of theoretically derived hypotheses about the structure, direction and relative sizes of the relation between aspects of the learning environment and a concurrent criterion (pupils’ well-being) as measured in the Pupils’ Survey. In tandem with the government’s quest for development and quality assurance of the learning environment, the significance of the present study resides in its contribution to the documentation of the quality of the tool (The Pupil Survey) for achieving the said purpose.

Conceptual and Theoretical Framework

Validity Evidence

Whilst there is an apparent unanimity that validity is of a single type – construct validity, evidence that support the claims about the uses and interpretations of survey or test results emanate from different sources (Hughes, 2018; Newton, 2012). The *Standards for educational and psychological testing* highlight the sources of validity evidence as: content, response process, relations with other variables, and evidence based on consequences (American Educational Research Association, American Psychological Association, & National Council on Measurement in Education, 2014). The present study is situated within the context of relations with other variables form of validity evidence.

Relations with other variables take two main forms – concurrent and predictive.

Whilst concurrent criterion associations involve predictors and criterion measured around the same time point, predictive associations deal with predictors and criterion measured at different time points (Hughes, 2018). Specifically, the present study takes the path of concurrent criterion association form of validity evidence. Based on the rational assumption that the implementing agency of the results of the Pupil Survey (Norwegian Directorate of Education and Training) implicitly gauges the quality of the learning environment through pupils' well-being, we conceived of the latter as a criterion co-occurring with the factors of the learning environment. We therefore have interest in the nature of the associations between the learning environment and well-being, and also whether the former explains appreciable variations in the criterion (Kline, 2016).

The Learning environment

According to the OECD (2016), the concept of learning environment spans the experience in the classroom (including classroom arrangement, disciplinary climate and instructional practices) through what happens in the school (including the design of the school building, violence and bullying in the school) to what happens in the school's wider social context (including parental involvement). Such a broader view of the learning environment creates an overlap with the concept of school climate.

Wang and Degol (2016) expatiates school climate as a multidimensional construct encompassing academic (leadership, teaching and learning, teacher training), community (inter-personal relationships such as pupil-teacher relationship, partnerships such as parental involvement), Safety (socio-emotional, physical safety, discipline and order) and the institutional environment (organizational features of the school environment). Similarly, Lewno-Dumdie et al. (2020) in a review of student-report measures of school climate identified five main dimensions – relationships, safety, institutional environment, teaching

and learning, and school improvement process. Whilst these largely compare with Wang and Degol (2016), there are subtle differences in the classification of sub-dimensions. For instance, whilst Wang and Degol subsume teaching and learning under academic dimension, it is rather considered as a main dimension in Lewno-Dumdie et al (2020). In a likewise manner, the discipline and order sub-dimension of school safety (Wang and Degol, 2016) is described broadly as norms and rules in Lewno-Dumdie et al (2020) of which the former is a part. Nonetheless, there is substantial overlap in how school climate is conceptualized in the two review studies. Meanwhile, as a result of the blur boundary between the concepts of learning environment and school climate, the present study conceives of their dimensions in an analogous manner. The measures of the learning environment in the Pupil Survey *inter alia*, relate to pupils perception of support from teachers, home support and a safe environment including outcomes such as motivation and well-being.

Pupils' perception of teacher support

Teachers as figure of socialization (Ryan et al., 1994) in school naturally confers on them a duty of care to pupils. The support that pupils receive from teachers could find theoretical explanation in the attachment theory (Bowlby, 1982). This theory is traditionally applied to study family interactions. However, it has provided theoretical foundation for a number of studies on pupil-teacher relationships (García-Moya, 2020). Inherent in the theory is the assumption that humans have basic needs including care, emotional security and protection which 'connect' them to others they perceive as able to satisfy these needs (Bowlby, 1982; García-Moya, 2020). Riley (2010) explains that a baby, bereft of the ability to completely meet its survival needs gravitates towards a caregiver (primarily a parent and significant others) otherwise its survival under threat. This innate care-seeking behaviour creates attachment (bond of affection) between the baby and the care giver. According to Bowlby (1982), this bond of affection provides the bedrock for all other relationships.

Similarly, pupils akin to a baby may perceive the teacher as caregiver (Riley, 2010). The thought that an ‘attachment figure’ (teacher) is available and responsive to the care seeker (pupil) develops in the latter a sense of security and encourages them to continue with the relationship (Bowlby, 1982). However, it is noteworthy that whilst attachment theory provides a framework for pupil-teacher relationships, the teacher’s role as possible attachment figure is often subordinate to family members (García-Moya, 2020). The teacher’s potential position as an attachment figure tends to be more pertinent for vulnerable pupils (Vershueren & Koomen, 2012 as cited in García-Moya, 2020).

The framework of attachment has guided the identification of three dimensions of measuring the quality of pupil-teacher relationship (García-Moya, 2020; Birch & Ladd, 1996). These dimensions are closeness (warmth and security, open communication), conflict (discordant interactions and lack of rapport) and over-reliance on teachers (dependency). The teacher support scale in the Pupil Survey overlaps mainly with the closeness dimension of pupil-teacher relationship. The closeness domain extends to the degree to which pupils find teachers as approachable, sharing feelings and experiences and considering them as a source of support and comfort. These are reflected in items such as ‘Do you feel that your teachers show they care about you?’, ‘Do you feel that your teachers believe that you can do well at school?’ and ‘I get help from my teachers when I have problems understanding assignments at school’.

Studies postulate positive association between support from teachers and pupils’ well-being (Bru et al., 2001; Chu et al., 2010). For instance, pupils who report greater well-being are associated with schools characterized by high level of teacher support (OECD, 2017). Furthermore, Birch and Ladd (1996) argue that pupil-teacher relationship characterised by warm and open communication facilitates positive affect and attitudes towards school. This is corroborated by Newland et al. (2019a) which found that the quality of pupil-teacher

relationship connects favourably to pupils' socioemotional outcomes. Also, teacher connectedness, pupils' belief that teachers in the school care about their welfare correlates positively with their well-being (García-Moya et al., 2015). Similarly, a recent study in Norway, found that teachers' demonstration of care, respect and warmth promotes pupils' adaptive functioning through motivation and mastery experience (Federici et al., 2016). We therefore hypothesise that teacher support will positively link to pupils' motivation, safe school environment and well-being pursuant to theory and empirical evidence.

Pupils' perception of home support

Support from home is part of the broader concept of parental involvement which includes behaviors parents exhibit and activities they engage in which are directly or indirectly linked to what their children do at school (Punter et al., 2016). In the literature, the concept of parental involvement or home-school collaboration or family school- partnership is often viewed within Epstein's framework (Epstein, 2001; Epstein & Connors, 1992). The framework identifies six dimensions of the construct: parenting, communicating, volunteering, learning at home, decision making and collaborating with the community. Guo and Wu (2018) explained that through parenting, parents are able to create conducive environment that supports children's learning at home. The communication dimension involves sharing of information between the school and parents regarding school policies and pupils' progress. This communication uses channels such as teacher-parent meetings and pupils' report cards. Parents may also volunteer to help with some school activities (Guo & Wu, 2018). However, Punter et al. (2016) drawing on the work of Bakker et al. (2007) summarized Epstein's dimensions as: home-based involvement (parenting, learning at home), school-based involvement (volunteering, school-community collaboration) and home-school communication (communicating and decision making).

In respect of measurement, Punter et al. (2016), indicated that home-based involvement such as receiving help with homework, parents keeping an eye on children, setting guidelines, and parent-child conversations about school are typically measured from pupil's perspective. The home-based involvement of parental involvement was conceptualized as home support in the Pupil Survey. This construct was indicated with items such as 'I get help at home with my homework' and 'My parents are interested in what I do at school'.

There are corroborative evidence of positive association between parental involvement and pupils' socioemotional and educational outcomes. For instance, the OCED (2017) found that parents' concern for the life of their children in general which also manifests in participation in school-related activities mattered for pupils' satisfaction with life and achievement at school. This is supported by the evidence that parents show of interest in what their children do at school positively affects their life satisfaction and well-being (Flouri and Buchanan, 2003; Suldo et al, 2013 ;Valérie, 2020). In addition, perceived parental competence and help with homework positively link to pupils' academic achievement and motivational outcomes such as academic self-concept and attitude towards homework (Dumont et al., 2011). This is consistent with earlier evidence that children report more positive attitude towards schoolwork and regular homework habits when parents are involved in their schoolwork (Epstein, 1985). Also, increased parental involvement in their child's school tasks also positively affects their cognitive and social functioning (Pomerantz et al., 2006). Based on the evidence in the literature, we expect pupils' perception of home support to share positive association with pupils' motivation and well-being.

Pupils' perception of a safe school environment

A safe school environment is that which guarantees and sustains positive school climate (Reeves et al., 2010). In an earlier study, Dwyer et al. (1998) through a synthesis of

research from variety of disciplines – education, psychology, social work – identified various characteristics of safe school environment. According to Dwyer et al. (1998), a safe school among other things focuses on academic achievement, involves families in meaningful ways, develops links to the community, emphasizes positive relationship among the community, and positive relationship among students and staff. A safe school also discusses safety issues openly, treats students with equal respect, create ways for students to share their concerns, help children feel safe expressing their feelings, have in a place for a system for referring children who are suspected of being abused or neglected, identifies problems and assess progress toward solutions (Dwyer et al., 1998). These characteristics compare with socio-emotional, discipline and order, and physical (such as reduced violence and aggression) dimensions of the safety domain of school climate (Wang & Degol, 2016). They are also consistent with the ‘norms and rules’ dimension of school safety which cuts across rules and expectations, consistency and clarity of rules, and fairness (Lewno-Dumdie et al., 2020). Although, safety at school is multidimensional, the present study focused on the order and discipline dimension which relates to pupils’ adherence to school rules as well as principles which promote orderliness such as clarity, fairness and consistency in the application of school rules (Wang & Degol, 2016). The reasoning is that the existence of clarity on acceptable behaviour, consistent and fair disciplinary practice in the school setting is primary for pupils’ safety and well-being.

The measure of the concept of a safe school in the present study includes items such as ‘The adults at my school set understandable expectations for how pupils should interact’ and ‘The adults in the school are consistent in their reaction when pupils break school rules’. We expect pupils’ perception of a safe school environment to correlate positively with well-being. This flows from the evidence that improving school safety matters for pupils’ well-being (Newland et al., 2019b) and positive social behaviour (Durlak et al., 2011). Similarly,

pupils' perceptions of fairness of school rules, orderly atmosphere and overall safety at school connect negatively to loneliness, anxiety and depression (Graham et al, 2006). These pieces of evidence are reinforced by the findings in a review study which indicated that the interrelatedness between a safe school environment and well-being are prerequisites for pupils' learning, social and emotional needs (Kutsyuruba et al., 2015). We also expect school safety as an intermediate outcome of the school setting to be associated with teacher and home supports. We ascribe this association to the teachers' status as the 'primary' adults at school and parents' role in inculcating discipline in children (Ismail, 2008; Ndamani, 2008).

Motivation from pupils' perspective

Pupils' motivation in the school context can be conceptualized within the framework of self-determination theory (STD; Deci & Ryan, 1980). The theory postulates that people's engagement in activity derives from conscious choice to satisfy a need (be it intrinsic or extrinsic) or take place mechanically without conscious processing of information (Deci & Ryan, 1980). In line with the former, the assumption is that such inherent tendencies lay the foundation for pupils' engagement or interest in schoolwork (Ryan & Deci, 2009). The Pupil Survey gauges pupils' motivation with focus on their interest in learning at school and how they like schoolwork.

Whilst STD emphasizes pupils' inner motivation as key resource to their achievement in learning activity, it also recognizes that it can be influenced by the experience with their surroundings (Deci & Ryan, 1980; Deci & Ryan, 1985). Given that pupil motivation takes place in the school context, it requires supportive conditions (Ryan & Deci, 2009) in the form of pupil-teacher relationship (Reeve, 2012). Therefore, teachers' role as facilitators in the school and parents as home facilitators are indispensable. Ryan et al. (1994) corroborate this claim with the finding that teachers and parents as symbols of socialization with respect to school, through their relationship with pupils produce in them positive attitudes and

motivations especially if the latter feels more secured with the former. However, it is worthy to note that the nature of the relationship between the support teachers and parents offer, and pupils' motivation also depends on the type of support – autonomy or controlling. Deci et al. (1981) provided evidence that pupils who receive autonomy support from teachers tend to be more intrinsically motivated, perceive themselves as competent and have improved self-worth. There is also evidence (including cross-culture) that parental autonomy support exerts greater influence on adolescents' well-being (Chirkov & Ryan, 2001; Ryan et al., 1994). We therefore expect that support from teachers and home support will share positive relation with motivation.

Furthermore, there is evidence that pupils who have the drive or desire to learn are associated with high sense of well-being relative to those who are 'constrained' to learn out of sense of obligation (Bailey & Phillips, 2016; Van Petegem et al., 2007). Similarly, a longitudinal examination of elementary school pupils showed that intrinsic self-motivation positively accounted for changes in pupils' psychological well-being (Burton et al., 2006). We therefore postulate a positive association between motivation and well-being.

Well-being and the learning environment

The concept of well-being is broad and interdisciplinary; it permeates psychology, sociology and philosophy (Steger, 2016). However, the two conceptual approaches that overwhelm discussion on the subject are subjective well-being and objective well-being (Ross et al., 2020).

Subjective approach to well-being dwells on personal experiences and individual fulfilment. This relates to what are termed in literature, eudemonic (Ryff, 1989) and hedonic well-being (Steger, 2016). On the other hand, objective approaches conceptualize well-being in terms of indicators that reflect quality of life such as material resources: income, food, clothing, shelter, and social characteristics: education, health, social support and community

(Forgeard et al., 2011; Western & Tomaszewski, 2016). However, given that the survey is a self-report of pupils' perceptions, the scope of our study coincides with subjective well-being.

The science of positive psychology explains subjective well-being in two forms – hedonic and eudaemonic. Hedonic well-being is characterized by sensory pleasures or emotions such as feeling happy and being content with one's life (Ross et al., 2020) whereas the eudemonic form involves experiences beyond emotional gratification (Steger, 2016) that allow individuals to have a purpose-driven life, achieving sustaining relationships with others and growing sense of realization (Ryff, 1989).

A more recent and popular theory on subjective well-being in the education literature is the Well-being theory or PERMA model (Seligman, 2011). The theory postulates that well-being is a construct which comprises five measurable elements: positive emotion, engagement, relationships, meaning and achievement. The theory further argues that these five elements represent useful ends for doing anything and that their combination gives rise to human flourishing; well-being (Goodman et al., 2018; Seligman, 2011). The strength of this theory is that it builds on earlier theories of well-being (Seligman, 2004) and provides a framework that blends both hedonic and eudaemonic perspectives of subjective well-being.

The first element, positive emotions, derive from hedonic well-being which relates to feelings of happiness such as being joyful, cheerful or content (Kern et al., 2015). The Pupil Survey took this view of the concept of well-being as it asks students to report their 'happiness' about some aspects of the learning environment. Engagement as an element of well-being refers to the extent to which individuals report being fully occupied and focused on what they are doing (Forgeard et al., 2011). High levels of engagement in adolescents are characterized by clarity of goals and innate interest in what they are engaged in (Hunter & Csikszentmihalyi, 2003). Although engagement and motivation are two different constructs,

they are inherently linked with each influencing the other (Reeve, 2012). We therefore expect this element of well-being to positively correlate with motivation.

The element of positive relationship is perhaps the most influential determinant of subjective well-being (Forgeard et al., 2011). Human beings find fulfilment in relationships. Haybron (2016) identified these relationships as taking the form of “close personal relationships, for instance for confidants: Feeling understood, respected and supported, social enjoyments: time spent enjoying the company others and community: living among people you like and trust, with whom you feel a sense of belonging”(p.45). These elements of well-being tie in with the support from teachers and parental involvement (Home-school collaboration) components of the learning environment. For instance, the survey elicits from pupils their perception of the support they receive from teachers such as care, respect and encouragement as well as the interest parents and adults show in their schoolwork. These are expected to be positively linked to student well-being (García-Moya et al., 2015; Pomerantz et al., 2006).

The meaning element of well-being refers to the belief that one’s activities are worthwhile which in general gives them a sense of purpose in life. This is often captured with items such as “I feel that on the whole, my life is focused on worthwhile goals”(Haybron, 2016, p. 46). However, the Pupil Survey does not have an explicit indicator on this element. The last element in the PERMA model is accomplishment. Accomplishment can be viewed in terms of achievement or success in a field but also refers to reaching a desired state and moving toward a valued aim or standard (Forgeard et al., 2011). Accomplishment requires a sense of purpose, the yearn to succeed and being confident about the future (Ross et al., 2020). This component of well-being is expected to share positive association with [intrinsic] motivation which according to Deci & Ryan (1980) is pursuit of an activity for its own sake, interest or rewards. Taken together, within the PERMA framework, the literature points to

association between pupils' perception of the learning environment and the elements of well-being (Reid & Smith, 2018).

The Present Study

We have discussed thus far, the extent to which aspects of the learning environment as measured in the Pupil Survey map onto theory and in turn connect to well-being. It is important to recap that the well-being theory (PERMA model; Seligman, 2011) which strengthens our conceptual model, emphasizes relationship (feeling loved, supported and valued by others) as an important pillar of well-being. Hence, our focus on the community dimension of school climate or learning environment which spans pupil-teacher relationships and parental involvement (Wang & Degol, 2016) as correlates of well-being. We also considered intermediate outcomes of the school setting such as motivation and a safe school environment.

The review of the literature pointed to positive associations between teacher support, home support, motivation, a safe school environment, and pupils' well-being. The central focus of our study is to confirm theoretically hypothesized relations between pupils' perception of these aspects of the learning environment and well-being using measures from the Pupils survey as a way of adding to the various sources of validity evidence to support the interpretation and use of the survey results. To do this, we test a theoretical model of relations (about the structure, direction, relative sizes) between the aspects of the learning environment and pupils' well-being (see Figure 1). The model was formulated based mainly on theoretical and empirical studies and supported with reasonable assumptions flowing from the literature review.

Research questions

In the present study, we sought to answer the following questions in respect of the relations between aspects of the learning environment and pupils' well-being as measured in the Pupil Survey.

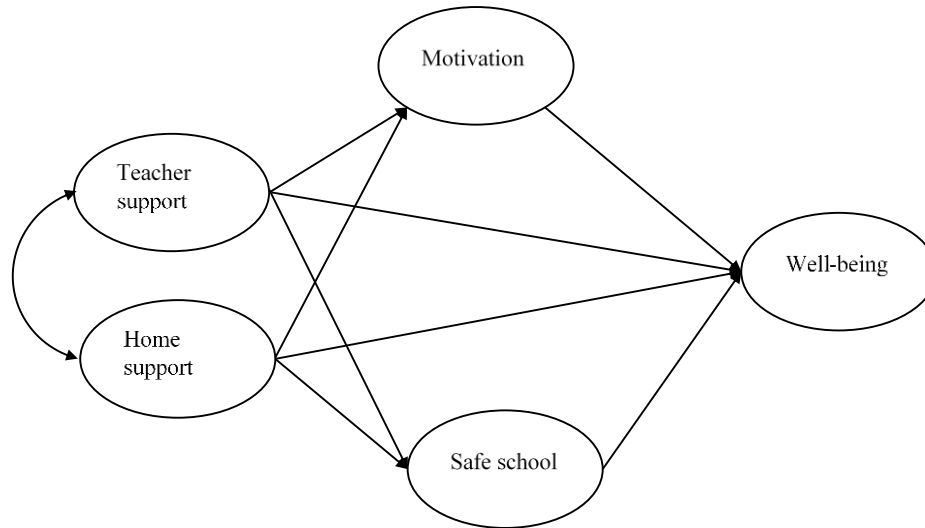
1. Do the Pupil Survey measures included in this study have acceptable measurement properties?
2. Do pupils' perception of teacher support and home support positively relate to their well-being?
3. Do pupils' motivational responses and perception of a safe school environment mediate the relation between their perception of teacher support, home support, and well-being?
4. Do the aspects of the learning environment explain appreciable variations in the criterion (well-being)?

Research hypotheses

We hypothesize that the measures from the Pupil Survey have acceptable measurement properties. We further hypothesize that pupils' perception of teacher support and home support will be positively associated with their well-being. In addition, we expect these relationships to be also mediated through safe school environment and motivation. Lastly, we hypothesize that factors of the learning environment will explain appreciable variations in pupils' well-being.

Figure 1

Theoretical model of relations between constructs



Methods

Participants and Procedure

The participants in the study were pupils who partook in the 2020 round of the Norwegian Pupil Survey. The survey is conducted twice in a year – autumn and spring. In autumn, it is required for schools to complete the survey but in spring, they can elect to conduct it. Participation is compulsory for schools in grade 7, 10 and 11. Schools can also ask pupils in grades 5 through 13 to take part in the survey but participation is optional (Wendelborg, 2021). However, we focused on respondents from grade 10. We surmised that grade 10 which falls between the other two grade levels (7 and 11) for which participation is mandatory might arguably present a balanced picture of well-being. Moreover, the educational program in the upper secondary schools are heterogenous with students self-selecting into a range of vocational and academic study programs and might introduce some complexities in our design.

The total number of tenth graders who participated in the autumn 2020 was 55,919 according to the data received for this study. However, in accordance with General Data

Protection Regulation (GDPR) requirements (see Appendix I), we excluded schools with low populations (less than 10 pupils; see Table A1) to avoid the potential risk of indirectly exposing identities of pupils. This reduced the number of respondents to 55,383.

Furthermore, the instrument for measuring well-being consisted of a core item which targets pupils' general well-being and other optional items. To circumvent the limitations of single-item constructs (Olsen, 2004), we included the optional items. Our sample was therefore restricted to complete cases on the well-being measure. In all, there were 12, 241 respondents comprising 50.4% boys and 49.6% girls. There were random missing values on items which constituted less than 2% of the total sample. To be certain that this approach did not yield a biased sample, we compared the mean and standard deviations of our sample with research units which were dropped. The two samples were compared on selected common items from each measure using Welch two-sample t-test. With the exception of home support and a safe school environment, the two samples differed on the selected indicators of well-being, teacher support and motivation (see Table A2). Nonetheless, the mean differences between the two samples are so small that they could also be regarded as substantially marginal (with effect size ranging, 0.03 [$d = 0.04$] to 0.06 [$d = 0.06$]).

Measures

The study used measures from the Pupil's Survey. Whilst the survey is administered in Norwegian, we considered the contents of the English version of the measures in the present study. The survey asks pupils to report on a range of constructs that matter for their learning and well-being in school (Wendelborg, 2021). However, as explained earlier, the measures considered in the present study are teacher support, home support, a safe school environment, motivation and well-being. These measures except well-being and a safe school environment are consistent with how they are reported in the annual main report of the Pupil Survey (Wendelborg, 2021).

Well-being

The annual main report of the Pupil Survey (Wendelborg, 2021) dwells on a single item to gauge pupils' general well-being. However, as explained early on, we considered all the 5 items on well-being (see Table 1). These items mainly map onto the elements of positive emotions and relationship which combine to nurture pupils' flourishing or well-being at school (Haybron, 2016; Seligman, 2011). The items on the scale span pupils' perception of their happiness in school to how well they feel comfortable or thrive in peer relationship. These are polytomous items with ordered categories from 'Do not enjoy at all/never (1)' to 'Enjoy very much/always (5)'. Therefore, a high (low) score on the indicators point to high (low) well-being of pupils. The internal consistency of the scale, measured as Cronbach's alpha was .83.

Teacher Support

The measure on support from teachers has 5 items (see Table 2). The items ask pupils to report their perception of support from teachers (be it emotional or academic) in terms of the number of teachers who extend such support. The first four items are ordered category items on a scale of 'None of the teachers (1)' to 'All of the teachers (5)'. Although these items do not elicit from pupils the degree of perceived teacher support, Federici et al (2016) argues it might provide an impartial measure of the learning environment as respondents rate teachers in general and not a specific teacher. The last item is on a scale of 'Disagree completely (1) to 'Agree completely (5)'. In all, a high (low) score on the scale indicates a high (low) 'count' or degree of perceived teacher support. The internal consistency of the scale, measured as Cronbach's alpha was .89.

Home Support

The survey capture pupils' perception of support from home with 3 items (see Table 3). These items tap mainly into parents' show of interest in their children's schoolwork

including encouraging and helping with homework. The items connect with the home-based involvement dimension of parental involvement or home-school collaboration (Punter et al, 2016). The items are scored on a 5-point scale ranging from ‘Never (1)’ to ‘Very often or Always (5)’. The underlying order is how frequently pupils perceive parents or adults at home as depicting this attribute. Therefore, a high(low) score indicates high(low) perceived school-related support from home. The scale had a Cronbach’s alpha of .82.

Motivation

Pupils’ motivation was measured in terms of their interest in learning, how well they like schoolwork and the extent to which they are keen about going to school. The scale comprises 3 items with different ordered categories (see Table 4). The responses run from ‘In no subject at all/not at all/disagree completely (1)’ to ‘In all or most subjects/very well/agree completely (5)’. Whiles the combination of different response categories raises questions about the appropriateness of the measure as a scale, previous analyses argue for its suitability (Federici et al., 2016; Wendelborg et. al., 2014; Wendelborg et al., 2015). The Cronbach’s alpha for the scale was .78.

A safe school environment

The measure for a safe school environment was adapted in line with the theoretical framework of learning environment or school climate (Wang & Degol, 2016). The measure in the present study aligns with the order and discipline dimension of school safety. It consists of 4 items (see Table 5) which tap into clarity on acceptable behaviour, fairness, and consistency of and adherence to school rules. The items are scored on a scale of ‘None/never (1)’ to ‘All/always (5)’. Therefore, a high (low) score on the scale suggests a high (low) pupils’ perception of school safety. The scale had a Cronbach’s alpha of .79.

Data analyses

In this sub-section, we describe the various steps involved in the analyses of the data. The analyses were conducted using 4.0.3 version of *R* statistical software (R Core Team, 2020). We first computed and reported the descriptive statistics of the data using base *R* to have a cursory look into the nature of distribution as well as measurement properties of the scales. We therefore reported the mean (*M*), standard deviations (*SD*), skew indexes and kurtosis. We relied on the conservative rule of thumb that absolute skew index of ≤ 3 and kurtosis index of ≤ 10 suggest less severe non-normal distribution (Kline, 2016). However, to avoid possible underestimation of standard errors we considered a robust maximum likelihood estimator (MLR) rather than the default estimator (ML) in *lavaan* package in *R* (Rosseel, 2012) which assumes multivariate normal distribution. We also utilized the full information function (case-wise) in the *lavaan* package (Rosseel, 2012) to account for cases with random missing values on items.

To learn about basic measurement properties of items and scales, we reported inter-item correlations, inter-construct correlations and the Cronbach's alpha (reliability coefficient). We also computed standardized factor loadings and composite reliability (CR; also called factor rho coefficient [see Appendix III]) to provide information on reliability of items and factors within a confirmatory factor analysis (CFA) framework. The CR is generally a credible alternative to the Cronbach's alpha which does not directly measure whether the indicators change on a single factor (Kline, 2016; Raykov, 2004).

To address the research questions/hypotheses, we adopted a two-step structural equation modelling (SEM) approach. We used this approach to allow for easy detection of the source of model misspecification in the event of one (Anderson & Gerbing, 1988; West et al., 2012). To investigate the psychometric properties of the scales, single factor models without and with error covariance between items were specified and evaluated for each scale

within a CFA framework. We performed chi-square difference (χ^2 diff) test to compare the two competing models. As noted earlier, some of the scales combined different response categories and we conceived the different underlying order as different methods of quantifying the same construct (akin to monotrait-multimethod). We further argued that this in addition to similarly worded items interfered with the randomness of measurement errors (Brown & Moore, 2012). However, the single factor models fitted to 3-item scales – support from home and motivation – were just identified (saturated). For such models, we only estimated and tested their parameters since the entire model could not be tested (Hoyle, 2012).

We evaluated the CFA models based on goodness-of-fit statistics. Given that the chi-square (χ^2) is sensitive to large sample (Brown & Moore, 2012), we reported the results in addition to other absolute, parsimony and comparative fit indices using the Hu and Bentler (1999) suggested guidelines for an acceptable model fit (Standardized root mean square residual [SRMR] close to .08 or below; Root mean square error of approximation [RMSEA] values close to .06 or below; Comparative fit index, [CFI] and Tucker – Lewis index [TLI] close to .95 or greater).

To test the research hypotheses, we specified the overall SEM model based on the proposed conceptual model (see Figure 1). The structural model was also evaluated subject to the Hu and Bentler (1999) guidelines. Finally, we tested the mediation (indirect) effects of support from teachers and home support on the criterion (well-being) using Wald test with bootstrapped standard errors (Fritz and Mackinnon, 2007; Muthen et al., 2017). The coefficient of determination (R^2) was used to gauge the explanatory power of the hypothesised model (Kline, 2016).

Results

This section comprises two sub-sections. The first part presents the traditional descriptive statistics and results of single factor models within a CFA framework. The latter is in line with the hypothesis that the measures from the Pupil Survey have acceptable measurement properties. The second sub-section relates to the results of the SEM regression which addresses the hypothesized structural relations between the constructs.

Descriptive Statistics and CFA Results

Table 1 relates to distribution of responses on the well-being scale. It also provides information on standardized factor loadings from two competing single factor models, M_1 (without error covariance) and M_2 (with error covariance) as well as the reliability of the measure.

Table 1

Distribution of responses, standardized factor loadings and composite reliability (well-being scale; n=12,241)

Item	Factor loadings					
	<i>M</i>	<i>SD</i>	Skew-ness	Kur-tosis	M_1	M_2
Do you:						
1. enjoy being at school	4.15	0.81	-1.30	2.23	.74	.72
2. have any fellow to play with during break or free periods	4.72	0.64	-2.93	10.35	.66	.65
3. enjoy being with the pupils in your group or class	4.25	0.80	-1.18	1.84	.76	.73
4. enjoy breaks/free periods	4.39	0.76	-1.47	3.00	.83	.87
5. ever feel lonely at school	4.94	0.94	-1.18	1.22	.59	.57
Composite reliability (<i>CR</i>)						.72

Note. The standardized factor loadings in both models are statistically significant ($p < .001$)

In Table 1, for the total sample of 12,241 pupils, the average responses on the items were high ranging, 4.15 on item 1 ($SD=.81$) to 4.94 on item 5 ($SD=.94$). Except for item 2, all the items had absolute skew indexes of ≤ 3 and kurtosis indexes of ≤ 10 . The items on the scale shared weak to moderate positive correlations (see Table A3).

M_1 and M_2 are two competing models specified without and with error covariances respectively based on the underlying order of response categories as described in the methods section. The chi-square difference test suggested that M_2 fits the data better ($\chi^2_{\text{diff}}(3) = 594.08, p < .001$; see Table A8). This is corroborated by a lower RMSEA of .026 (90% CI [.016, .038]) reported in M_2 compared with .10 (90% CI [.093, .106]) in M_1 . Besides items 2 and 5, the standardized factor loadings were greater than .70. Overall, about 72 % of the total variations in the indicators were attributable to the latent factor ($CR = .72$).

Table 2 shows response distribution on the teacher support scale. The table also presents the results of two candidate models, M_1 (without error covariance) and M_2 (with error covariance).

Table 2

Distribution of responses, standardized factor loadings and composite reliability (Teacher support scale)

Item	Factor loadings					
	<i>M</i>	<i>SD</i>	Skew-ness	Kur-tosis	M_1	M_2
1. Do you feel that your teachers show they care about you	3.98	0.84	-1.06	1.95	.84	.86
2. Do you feel that your teachers believe you can do well at school?	4.12	0.84	-1.15	2.05	.84	.85
3. Do you feel that your teachers treat you with respect?	4.13	0.85	-1.14	1.87	.81	.81
4. I get help from my teachers when I have problems understanding assignments at school	4.05	0.80	-0.93	1.68	.75	.72
5. My teachers help me understand what I am intended to learn	4.05	0.88	-1.03	1.29	.69	.65
Composite reliability (<i>CR</i>)						.86

Note. The standardized factor loadings in both models are statistically significant ($p < .001$)

In table 2, on average the responses on the items are stable around point 4 (most/agree) on the scale with standard deviations ranging, .80 (on item 4) to .88 (on item 5). The absolute skew and kurtosis indexes are within the rule of thumb (skew index ≤ 3 and kurtosis index ≤ 10) for non-severe normal distribution. The correlations between the items were positive and moderate (ranging, .55 to .74; see Table A4).

The single factor models were specified without (M_1) and with error covariance (M_2) based on similarly worded items (items 4 and 5). The results of the chi-square difference test showed that M_2 which has more freely estimated parameters fits the data better ($\chi^2_{\text{diff}}(1) = 1373, p < .001$; see Table A8). Similarly, the RMSEA in M_2 (.046, 90% CI [.039, .054]) was lower than the RMSEA in M_1 (.156, 90% CI [.149, .162]; see Table A7). In model 2, all the items loaded saliently to the factor (ranging, .65 to .86). At the scale level, about 86% of the total variations in the indicators were explained by the underlying factor.

Table 3 relates to distribution of responses on the home support scale. The table also presents results of the single factor model.

Table 3

Distribution of responses, standardized factor loadings and composite reliability (Home support)

Item	<i>M</i>	<i>SD</i>	Skew-ness	Kur-tosis	Factor loadings
1. My parents are interested I what I do at school	4.19	0.95	-1.11	0.75	.79
2. I get help at home with my homework	3.93	1.17	-0.97	0.07	.75
3. The adults at home encourage me to do schoolwork	4.22	1.00	-1.31	1.17	.79
Composite reliability (<i>CR</i>)					.82

Note. The standardized factor loadings in both models are statistically significant ($p < .001$)

In Table 3, the responses on the items tend to centre on point 4 (“often”) of the home support scale with standard deviations varying between .95 and 1.17. The absolute skew

indexes were less than 3 and the kurtosis indexes were less than 10 for all items. The items shared strong positive associations (ranging, .60 to .63; see Table A5).

The single factor model imposed on the home support data was just identified (saturated) so we only estimated and tested the model parameters. The standardized factor loadings which range from .75 to .79 indicate that adequate proportion of the variations in the indicators were attributable to the underlying factor. The composite reliability was .82.

Table 4 reports the response distribution on the motivation scale. It also reports standardized factor loadings as well as composite reliability from the single factor model.

Table 4

*Distribution of responses, standardized factor loadings and composite reliability
(Motivation)*

Item	<i>M</i>	<i>SD</i>	Skew-ness	Kur-tosis	Factor loadings
1. Are you interested in learning at school?	3.87	0.95	-0.64	0.05	.74
2. How well do you like schoolwork?	3.17	0.97	-0.32	-0.26	.86
3. I look forward to going too school	3.34	1.13	-0.47	-0.47	.65
Composite reliability (<i>CR</i>)					.79

Note. The standardized factor loadings in both models are statistically significant ($p < .001$)

In Table 4, on average pupils response on the items varied from point 3 (In some subjects) to point 4 (In many subjects) on the scale with standard deviations ranging, .95 to 1.13. The absolute skew and kurtosis indexes ranged from .32 to .64 and .05 to .47 respectively. The inter-item correlations were positive and moderate (ranging, .48 to .63; see Table A6)

The single factor model to the motivation data was just identified so we estimated and tested only the parameters. In Table 4, whilst considerable percentage of the variations in items 1 and 2 were due to the underlying factor ($.74^2=55\%$ and $.86^2=74\%$ respectively), item

3 weakly loaded to the factor ($.64^2=41\%$). At the scale level, approximately 79% of the changes in the indicators were accounted for by the underlying factor ($CR=.79$)

Table 5 depicts the descriptive statistics and CFA results from the single factor models, M_1 and M_2 fit to the safe school environment data.

Table 5

Distribution of responses, standardized factor loadings and composite reliability (Safe school)

Item	Factor loadings					
	<i>M</i>	<i>SD</i>	Skew-ness	Kur-tosis	M_1	M_2
1. The adults at my school set understandable expectations for how pupils should interact.	4.35	0.73	-1.31	2.91	.79	.56
2. Do the adults at your school react when someone says or does something that is not nice or is mean to another pupil?	4.05	0.88	-1.09	1.69	.70	.66
3. The adults make sure we follow the rules for how we should behave at school?	4.11	0.85	-1.02	1.35	.62	.69
4. The adults at this school are consistent in their reactions when pupils break the rules	3.64	1.10	-0.60	0.27	.70	.80
Composite reliability (<i>CR</i>)						.72

Note. The standardized factor loadings in both models are statistically significant ($p<.001$)

In table 5, pupils had the tendency to endorse items with point 4 (most/agree a little) on the scale. The absolute skew indexes (ranging, 0.60 to 1.31) and kurtosis indexes (ranging, 0.027 to 2.91) satisfied the conservative rule of thumb for less severe non-normal distribution. The items shared moderate to strong positive associations (See Table A7).

We specified the safe school environment construct as a single factor in CFA, first assuming random measurement error (M_1) and second, freely estimating residual covariances (M_2) based on underlying order of items as argued earlier. The chi-square difference test revealed M_2 as the best fitting model ($\chi^2_{diff}(1) = 871.55, p<.01$; see Table A7). This result is

reaffirmed by the lower RMSEA (.058, 90% CI [.044, .074]) in M_2 compared with M_1 (.194, 90% CI [.183, .204]; see Table A8). At the item level, the standardized factor loadings (ranging, .56 to .80) suggest that the underlying factor explain adequate variations in the indicators. At the scale level, about 72% of the total variations in the items emanated from the latent factor ($CR=.72$).

In Table 6, we provide the distribution and inter-construct correlations for variables in the structural model. We obtained the scores of the measures as average responses of each pupil across items they endorsed on the scale. The absolute skewness and kurtosis were less than 3 (ranging, .52 to 1.55) and 10 (ranging, .03 to 3.66) respectively suggesting an approximate normal distribution.

Table 6

Descriptive statistics and inter-construct correlations

Construct						Correlations				
	<i>M</i>	<i>SD</i>	Skewness	Kurtosis	WB	TS	HS	MOT	SSE	
Well-being (WB)	4.33	0.62	-1.55	3.66	-					
Teacher support (TS)	4.06	0.70	-1.19	2.51	.43	-				
Home support (HS)	4.11	0.90	-1.07	0.72	.32	.35	-			
Motivation (MOT)	3.46	0.85	-0.52	0.03	.41	.51	.40	-		
Safe school (SSE)	4.04	0.71	-0.93	1.28	.36	.58	.34	.36	-	

Note. The inter-construct correlations are statistically significant ($p<.001$)

Table 6 also shows that for a sample size of 12,241 pupils in tenth grade, the central tendency on both teacher support ($M=4.06$, $SD=0.70$) and a safe school environment ($M=4.04$, $SD=0.71$) variables was 4.0. In addition, home support ($M=4.11$, $SD=0.73$) and positive school outcomes such as motivation ($M=3.46$, $SD=0.80$) and well-being ($M=4.33$, $SD=0.62$) were endorsed with high mean scores. Furthermore, there was generally low to moderate positive correlations between the constructs. For instance, whereas as the strongest association was between teacher support and a safe school environment ($r=.59$), the weakest

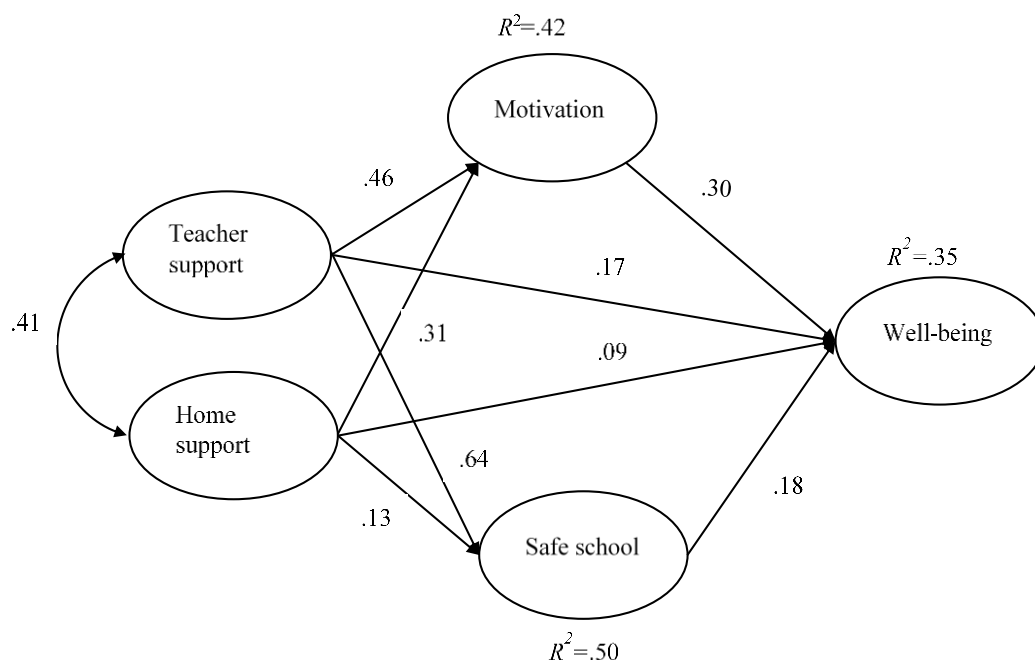
correlation was between home support and well-being ($r=.32$). Overall, the direction of associations between the variables were consistent with expectation.

SEM Regression Results

In line with the hypothesized structural relations between the constructs, we estimated and tested the theoretical model depicted in Figure 1. The results of the estimated structural model suggested an acceptable fit to the data. Although the chi-square test yielded a statistically significant result ($\chi^2(156) = 4847.245, p < .001$), the other goodness-of-fit statistics were consistent with their respective cut-offs (RMSEA=.050, 90% CI [.048, .051]; SRMR=.038; CFI=.960; TLI=.951). Figure 2 shows the standardized path coefficients and the coefficient of determination (R^2) of the estimated structural model.

Figure 2

Standardized path coefficients and R^2 from the estimated conceptual model



Note. All the standardized path coefficients are statistically significant ($p < .001$)

We hypothesized that pupils' perception of teacher and home support positively relate to well-being. Consistent with the hypothesis, we found evidence of positive association

between two factors of the learning of environment and pupils' psychological outcome (well-being). The standardized path coefficient ($\beta=.17$ (.019), $p<.001$) indicate that a stronger perception of teacher support is associated with higher levels of well-being. Similarly, the standardized path coefficient from home support to well-being ($\beta=.09$ (.014), $p<.001$) supported the hypothesis that pupils who report high levels of home support tend to report high well-being.

In addition, we found that pupils' motivational responses and perception of a safe school environment increased with their perception of the support they receive from teachers and the home. The standardized path coefficients from teacher support to motivation and a safe school environment were $\beta=.46$ (.012), $p<.001$ and $\beta=.64$ (.011), $p<.001$ respectively. In a similar manner, the standardized path coefficients from home support to motivation and a safe school environment were $\beta=.31$ (.012), $p<.001$ and $\beta=.13$ (.012), $p<.001$ respectively.

We also hypothesized that motivation and pupils' perception of a safe school environment mediate the relation between teacher support, home support, and well-being. In Table 7, the two mediation variables shared statistically significant association with pupil's well-being (*Motivation*: $\beta=.30$ (.019), $p<.001$; *safe school environment*: $\beta=.18$ (.018), $p<.001$). The results of the Wald test for mediation with bootstrapped standard errors supported the hypothesized mediation path model (See Table 7). Specifically, we found evidence of partial indirect effects. That is, the indirect effects of teacher support on well-being through motivation and a safe school environment were statistically different from zero (.13, 95% CI [.11, .16]; .11, 95% CI [.090, .138] respectively). Home support also had statistically significant indirect effect on pupils' well-being through motivation and safe school environment (.09, 95% CI [.07, .10]; .02, 95% CI [.02, .03] respectively). These results were amidst statistically significant total effect of teacher support (.41, 95% CI [.38, .44]) and home support (.20, 95% CI [.18, .22]) on well-being.

Table 7

Standardized direct, indirect and total effects of teacher support and home support on well-being

Construct	Effects on well-being							
	Direct	SE	Indirect 1	SE	Indirect 2	SE	Total	SE
Teacher support	.160*	.020	.133*	.011	.113*	.012	.406*	.016
Home support	.090*	.013	.086*	.007	.022*	.003	.198*	.012

Note. * $p < .001$. A Wald test with bootstrapped standard errors (*SE*) was used to test for indirect and total effects using 2000 samples. *Indirect 1* = Indirect effect of the exogenous variable through motivation; *Indirect 2* = Indirect effects of the exogenous variable through a safe school environment

Lastly, we hypothesized that the measures of the learning environment explained appreciable amount of the variations in the criterion (well-being). The results (see Figure 2) revealed that, overall, the exogenous variables accounted for about 35% of the variations in well-being ($R^2 = .35$)

Discussion

The present study sought to contribute to the accumulation of theoretical and empirical evidence to support the interpretation and use of the Pupil Survey results by testing a model of theoretically derived hypotheses about the relations between aspects of the learning environment and well-being as measured in the survey. We found that the measures in the survey generally have acceptable measurement properties. We also found that pupils' perception of teacher support and support from home were positively associated with pupils' well-being in accordance with theory. These relations were partially mediated through motivation and a safe school environment as hypothesised.

With respect to the hypothesis that the measures in the Pupil Survey have acceptable psychometric properties, the results of the confirmatory factor analysis were consistent with expectation. As indicated by moderate to high composite reliabilities, adequate variations in

the indicators were explained by the underlying factor in each measure. The single factor models imposed on the measures demonstrated acceptable fit. The evidence that the set of indicators changed on a single factor is consistent with the properties of the measures hinted in the report on analyses of the various waves of the Pupil Survey (Federici & Wendelborg, 2015; Wendelborg et al., 2015; Wendelborg, 2021). However, the combination of different ordered categories on the same scale introduced residual correlations which meant that measurement error was not random. In other words, the variations in the indicators were also attributable to other reasons beyond the underlying factor (Brown and Moore, 2012). Therefore, the traditional practice of quantifying latent variables with simple average or sum scores will not be reasonably applicable.

In line with the hypothesized structural relations, the results from the estimated structural model were congruent with expectations. We found a direct positive association between pupils' perception of teacher support and well-being. A reasonable assumption is that pupils who perceive 'high' emotional and academic support from teachers tend to flourish at school. This ties in with the theoretical supposition (attachment theory) that psychological connectedness in the form of consistent emotional support from care givers (teachers) develop in children (pupils) a sense of security and comfort (Bowlby, 1982; Riley, 2010; Wang & Degol, 2016). This result is analogous to the evidence from Norway that teachers show of care, respect and warmth promotes pupils' adaptive functioning (Federici et al., 2016). The latter supports pupils' ability to develop relationship with others which makes them thrive at school. Other empirical studies (Birch and Ladd 1996; García-Moya et al., 2015; Valérie et al., 2020; Wang et al., 2020) corroborate these findings.

We also found evidence on direct positive relation between support from home and well-being. It seems plausible that when parents and adults at home show interest in what children do at school (be it actively helping with their homework or encouraging them to do

schoolwork), it connects favourably with pupils' feeling of 'happiness' at school. However, it should be noted that conceptually, support from home as measured in the Pupil Survey coincides with the home-based involvement dimension of the broader concept of parental involvement or home-school collaboration (Epstein, 2001; Epstein & Cornors, 1992; Punter, 2016). The evidence of positive association between parental support and pupils' positive psychological outcomes is supported by earlier studies (Chu et al., 2010; Pomerantz et al., 2006; Epstein, 1985; Wang & Degol, 2016).

There was also evidence that the respective relations between pupils' perception of teacher support, home support and well-being were partially mediated through motivation. The results suggest that pupils who report positive perception about emotional and academic support from teachers as well as home support also show interest in school which indirectly links to their flourishing. This result is consistent with self-determination theory (Deci & Ryan, 1980, Deci & Ryan, 1985; Ryan & Deci, 2009) which emphasises pupils' inner drive, needs and experience and at the same time gives room for need-supportive conditions such as pupil-teacher relationships and parental involvement (Reeve, 2012). Previous studies such as Burton et al (2006) and Ryan et al (1994) also support the positive association between motivation and well-being.

Pupils' perception of teacher support and support from home also indirectly connected to pupils' well-being through their perception of a safe school environment. It could be argued that when pupils have positive perception about support from teachers and school-related support from home it bears on their perception of safety at school and subsequently their well-being. This arguably highlights the [indirect] role of the home (parents) in contributing to order and discipline at school (Ismail, 2018; Ndamani, 2008). On the other hand, it is worth highlighting that teacher support shared the strongest association with pupils' perception of a safe school environment. It is conceivable that the strong relation

stemmed from the fact that teachers (primarily the adults at school) were the object of evaluation in both measures. Also, the safe school measure as noted earlier, overlapped with the order and discipline dimension of school safety (Wang & Degol, 2016). The strong association arguably emphasises teachers' role as key participants in the application and enforcement of school rules. In turn, the nexus between a safe school environment and well-being is corroborated in the literature (Graham et al., 2006; Kutsyuruba et al., 2015). Overall, the factors of the learning environment explained appreciable variations in well-being lending to criterion- related validity (Kline, 2016).

The present study makes both methodological and practical contributions to the literature. Methodologically, our study provides an example on concurrent criterion associations type of validity evidence using structural equation modelling (Hughes, 2018). On the practical side, we have contributed to the validation of an important national survey which shapes policy directions in an education system. The implications are that cross-sectional prediction with both predictors and criterion provide a vehicle for validity studies. Most importantly, our findings to some extent justify the continuous use and interpretation of the results from the Pupil Survey to inform stakeholders of the Norwegian community about learning and well-being at school.

Typical of scientific endeavours, the present study has its share of limitations. The Pupil Survey comprises self-reported measures. The study therefore inherits the limitations of self-reported data such as potential response bias and inability of some pupils to accurately place themselves on the scales. The study also uses cross-sectional data which does not support causal interpretations. Causal inferences will be more appropriate within a longitudinal design. In addition, other dimensions of school safety such as bullying and violence matter for pupils' well-being. However, they were outside the scope of the present study. Future studies should therefore compensate for this. Also, models fitted to 3-item

measures such as motivation and support from home were saturated. This means the entire model could not be evaluated except the parameter estimates. We recommend that future revision of the survey should pay attention to this to allow for comprehensive item-level factor analysis. As alluded to earlier, the combination of different response categories tainted the randomness of measurement errors. Any intended revision of the survey should consider the same type of ordered categories for each of the measures. Lastly, due to practical constraints, we restricted our study sample to pupils from schools which administered the optional items on well-being. Although the schools which administered these items and those who did not differed statistically on mean values, the differences were so small that they could also be regarded as substantially marginal.

In conclusion, the measures in the Pupil Survey considered in the present study have acceptable psychometric properties. At the same time, they lend to theoretically derived hypotheses of structural relations. Nonetheless, amidst the constraints, our findings should be contemplated as an addition to the many steps towards establishing the quality of the measures in the Pupil Survey.

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Appendix I

GDPR Documents & Ethical Approval

Ethical approval

Our study involved the processing of personal data. We therefore applied and obtained approval from the Norwegian centre for research data (NSD). The NSD application was done through the administrator of the project (*The Pupil Survey as a measure of school quality*) of which this thesis is part. Furthermore, due to the well-being component of the Pupil Survey data used in the present study, the data was classified as ‘red’ by the University of Oslo (UiO) data classification – information the university is required to protect by law, agreement and other regulations. This imposed on us stringent ethical obligations. To satisfy the Norwegian instructions for information protection and GDPR requirements of integrity and confidentiality of processing personal data, the members of this project (the author and supervisors) through the Centre for Educational Measurement (CEMO) signed a confidential agreement with the Norwegian Directorate of Education and Training, the custodian of the Pupil Survey data. Throughout the project, the data was stored and analysed within the Sensitive Data Services (TSD) environment. Access to the data required a two step-verification (an authentication number and personal password). The main supervisor (the administrator of this project) ensured strict adherence to the guidelines set out in the confidential agreement to avoid any data protection breaches. The copies of NSD application and approval, confidentiality agreement and Privacy protection assessment (DPIA) can be found under *GDPR documents*.

GDPR documents

NSD Application

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Meldeskjema for behandling av personopplysninger



Meldeskjema

Referansenummer

624792

Hvilke personopplysninger skal du behandle?

- Bakgrunnsopplysninger som vil kunne identifisere en person
- Helseopplysninger

Beskriv hvilke bakgrunnsopplysninger du skal behandle

I dette datasettet finnes et løpenummer for skole. Det finnes også en variabel for klassetrinn (7, 10 eller 11) og for det høyeste trinnet finnes det også en variabel for skoleslag. Disse opplysningene kan teoretisk koples mot data fra åpne registre (skoleporten.no eller Grunnskolenes informasjonssystem). Dermed kan man eksempelvis benytte elevtall og trinn for å finne skolens navn. Sannsynligheten for at man skal lykkes med dette er liten fordi elevtallet i datafila fra Elevundersøkelsen med stor sannsynlighet ikke er likt antallet i disse registrene, og videre fordi antall elever ikke er unik for skoler

Prosjektinformasjon

Prosjekttittel

Analyse av data fra Elevundersøkelsen

Prosjektbeskrivelse

Vi får utlevert et datasett fra Utdanningsdirektoratet, og har opprettet en avtale om dette (se vedlegg). Dette er data fra den årlige spørringen som de administrerer blant elever i utvalgte skoletrinn i Norge (Elevundersøkelsen). Det er ingen direkte person- eller skoleidentifiserende opplysninger, men det kan finnes en mikroskopisk teoretisk mulighet for indirekte identifisering gjennom kopling av dette datasettet og offentlig tilgjengelige opplysninger. Datasettet skal benyttes for masteroppgaver tidligst fra våren 2021

Dersom opplysningene skal behandles til andre formål enn behandlingen for dette prosjektet, beskriv hvilke

I etterkant av at masteroppgavene er levert vil det bli vurdert om dette er av en slik kvalitet at det kan medføre publisering i et vitenskapelig tidsskrift

Begrunn behovet for å behandle personopplysningene

Vi har et behov for å tilby våre masterkandidater reelle data som de kan benytte for å gjøre nyttige og samfunnsrelevante analyser. Data fra Elevundersøkelsen behandles av Utdanningsdirektoratet for å utvikle en rekke kvalitetsindikatorer. Disse indikatorene har stor betydning for skolers og skoleeieres kvalitetsarbeid. Analysene som våre studenter gjør, vil dreie seg om å undersøke i hvilken grad indikatoren har en god psyometrisk/teknisk kvalitet for dette formålet. Prosjektbeskrivelsen som er lagt til, er den teksten som studentene får tilgang til, og ut fra dette skal de selv utvikle sin egen prosjektbeskrivelse. Studentene vil

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Meldeskjema for behandling av personopplysninger

derfor selv melde sine egne spesifikke prosjekter når den tid kommer - med referanse til dette overordnede paraplyprosjektet.

Ekstern finansiering**Type prosjekt**

Forskerprosjekt

Behandlingsansvar

Behandlingsansvarlig institusjon

Universitetet i Oslo / Det utdanningsvitenskapelige fakultet / Centre for Educational Measurement

Prosjektansvarlig (vitenskapelig ansatt/veileder eller stipendiat)

Rolf Vegar Olsen, rolfo@cemo.uio.no, tlf: 98859376

Skal behandlingsansvaret deles med andre institusjoner (felles behandlingsansvarlige)?

Nei

Utvalg 1

Beskriv utvalget

Undersøkelsen er obligatorisk for alle norske skoler med elever i trinnene 7, 10 og 11. For elevene er deltakelse frivillig. Utvalget er derfor i utgangspunktet disse tre populasjonene, men med frafall

Rekruttering eller trekking av utvalget

Som sagt obligatorisk deltakelse. Skjema kan ikke lastes opp som en fil, men er i sin helhet tilgjengelig via lenker her: <https://www.udir.no/tall-og-forskning/brukerundersokelser/Om-temaene-i-Elevundersokelsen/>

Alder

12 - 17

Inngår det voksne (18 år +) i utvalget som ikke kan samtykke selv?

Nei

Personopplysninger for utvalg 1

- Bakgrunnsopplysninger som vil kunne identifisere en person
- Helseopplysninger

Hvordan samler du inn data fra utvalg 1?**Elektronisk spørreskjema****Grunnlag for å behandle alminnelige kategorier av personopplysninger**

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Meldeskjema for behandling av personopplysninger

Allmenn interesse eller offentlig myndighet (art. 6 nr. 1 bokstav e)

Redegjør for valget av behandlingsgrunnlag

Utdanningsdirektoratet samler dataene som et ledd i sitt lovpålagte arbeid med å monitorere kvalitet i utdanningssystemet. Vår behandling av opplysninger er i tråd med dette formålet ved at prosjektene studerer kvaliteten i datagrunnaget og indikatorene

Grunnlag for å behandle særlige kategorier av personopplysninger

Arkivformål i allmenhetens interesse, eller for formål knyttet til vitenskapelig eller historisk forskning eller for statistiske formål (art. 9 nr. 2 bokstav j)

Redegjør for valget av behandlingsgrunnlag

Studentprosjektene som inngår skal undersøke reliabilitet og validitet til indikatorer som i dag offentliggjøres for skoler, bl.a. knyttet til elevers trivsel. Det er i allmenhetens interesse at slike kvalitetsindikatorer har høy statistisk kvalitet

Informasjon for utvalg 1**Informerer du utvalget om behandlingen av opplysningene?**

Nei

Begrunn hvorfor du ikke informerer utvalget om behandlingen.

Dette er data som Utdanningsdirektoratet har lagret for eget formål og som når det er avidentifisert kan benyttes for forskningsformål

Tredjepersoner

Skal du behandle personopplysninger om tredjepersoner?

Nei

Dokumentasjon

Hvordan kan de registrerte få innsyn, rettet eller slettet opplysninger om seg selv?

De kan ikke få innsyn, rette eller slette disse opplysningene

Totalt antall registrerte i prosjektet

100.000+

Tillatelser

Skal du innhente følgende godkjenninger eller tillatelser for prosjektet?

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Meldeskjema for behandling av personopplysninger

- Dispensasjon fra taushetsplikten fra departement eller direktorat

Behandling

Hvor behandles opplysningene?

- Maskinvare tilhørende behandlingsansvarlig institusjon

Hvem behandler/har tilgang til opplysningene?

- Prosjektansvarlig
- Student (studentprosjekt)
- Interne medarbeidere

Tilgjengeliggjøres opplysningene utenfor EU/EØS til en tredjestat eller internasjonal organisasjon?

Nei

Sikkerhet

Oppbevares personopplysningene atskilt fra øvrige data (koblingsnøkkel)?

Nei

Begrunn hvorfor personopplysningene oppbevares sammen med de øvrige opplysningene

Det er ingen kodenøkkel. Dataene er aidentifisert. Prosjektet meldes kun fordi det finnes en teoretisk, men svært usannsynlig mulighet til kople mot andre data for å finne skoleidentitet. Sannsynligheten for så å kunne identifisere personer ser jeg for meg er tilnærmet lik 0. TSD vil bli benyttet

Hvilke tekniske og fysiske tiltak sikrer personopplysningene?

- Opplysningene anonymiseres fortløpende
- Opplysningene krypteres under forsendelse
- Opplysningene krypteres under lagring
- Adgangsbegrensning
- Flerfaktorautentisering
- Endringslogg
- Adgangslogg

Varighet

Prosjektperiode

12.03.2020 - 01.06.2025

Skal data med personopplysninger oppbevares utover prosjektperioden?

Nei, data vil bli oppbevart uten personopplysninger (anonymisering)

Hvor oppbevares opplysningene?

<https://meldeskjema.nsd.no/eksport/5e69f1ae-1ea9-4fae-b74a-7d417f22c8ea>

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Meldeskjema for behandling av personopplysninger

Internt ved behandlingsansvarlig institusjon

Hvilke anonymiseringstiltak vil bli foretatt?

- Annet

Skoler med færre enn ti elever vil bli slettet fra fila før behandling. På denne måten vil det være nærmest umulig å kople data fra denne fila med offentlige databaser (Skoleporten, GSI) hvor tallmaterialet er offentliggjort som gjennomsnitt for skoler og høyere administrative enheter

Vil de registrerte kunne identifiseres (direkte eller indirekte) i oppgave/avhandling/øvrige publikasjoner fra prosjektet?

Nei

Tilleggsopplysninger

Dette er altså et eksisterende administrativt datasett. Det har tidligere også blitt brukt til forskningsformål. Dataene vil ikke i seg selv offentliggjøres. Alle studentoppgaver, artikler eller liknende, vil kun rapportere resultater for analyser. Det vil derfor ikke finnes noen presentasjon av data fra begrensede aggregater fra datasettet. Det vil derfor ikke være noen som helst mulighet for identifisering fra dokumenter som er offentlig tilgjengelige. Dersom datafila fra Utdanningsdirektoratet inneholder skoler med færre enn 10 elever, vil disse umiddelbart slettes for ytterligere å redusere muligheten for indirekte identifisering. Jurister ved Utdanningsdirektoratet kommet fram til at data skal behandles som om indirekte identifisering er teoretisk mulig. Forøvrig kan det føyes til at data allerede er tilgjengelige for offentligheten i form av gjennomsnitt for skoler og høyere administrative nivåer (kommune og fylkeskommune). I henhold til utleveringsavtalen med Utdanningsdirektoratet er det også foretatt en personvernkonsekvensutredning (DPIA) som er vedlagt her, sammen med signering fra UiO

Privacy Protection Assessment (DPIA)

1/25/2021

Meldeskjema for behandling av personopplysninger



NSD sin vurdering

Prosjekttittel

Analyse av data fra Elevundersøkelsen

Referansenummer

624792

Registrert

12.03.2020 av Rolf Vegar Olsen - rolfvo@uio.no

Behandlingsansvarlig institusjon

Universitetet i Oslo / Det utdanningsvitenskapelige fakultet / CEMO - Centre for Educational Measurement

Prosjektansvarlig (vitenskapelig ansatt/veileder eller stipendiat)

Rolf Vegar Olsen, rolfvo@cemo.uio.no, tlf: 98859376

Type prosjekt

Forskerprosjekt

Prosjektperiode

12.03.2020 - 01.06.2025

Status

04.12.2020 - Vurdert DPIA

Vurdering (1)

04.12.2020 - Vurdert DPIA

Prosjektet ble ved innmelding vurdert å innebære en høy risiko for de registrertes rettigheter og friheter, noe som utløser krav om personvernkonsekvensvurdering (DPIA) jf. personvernforordningen art. 35. NSD har i samråd med prosjektansvarlig og personvernombud gjennomført en slik vurdering.

Ved å gjennomføre de planlagte tiltakene, mener NSD at personvernrisikoen er redusert i en slik grad at behandlingen kan gjennomføres i samsvar med personvernforordningen, uten behov for forhåndsdrøfting med Datatilsynet. Behandlingsansvarlig institusjon har bekreftet at vurderingen er tilfredsstillende utført og at prosjektet kan gjennomføres, jf. DPIA godkjent 03.12.2020.

Extradition Agreement

Utleveringsavtale - The Pupil Survey as a measure of school quality

Dette dokumentet er signert digitalt av følgende undertegnere:

- ROLF VEGAR OLSEN (25046823934), signert 21.04.2020 med ID-Porten: BankID Mobil

**Dokumentet inneholder**

- En forside med informasjon om signeringen
- Originaldokumentet med signatordetaljer på hver side
- Digitalt integrerte signaturer

**Dokumentet er forseglet av Posten Norge**

Signeringen er gjort med en signaturtjeneste fra Posten Norge AS. Posten garanterer dermed for autensiteteten og forseglingen av dette dokumentet.

**Slik ser du at signaturen er gyldig**

Hvis du åpner dokumentet i Adobe Reader, skal det stå øverst at dokumentet er sertifisert av Posten Norge AS. Dette garanterer at innholdet i dokumentet ikke er endret etter signering.



Utleveringsavtale

Avtale om utlevering av taushetsbelagte opplysninger til bruk i forskning mellom Utdanningsdirektoratet og Centre of Educational Measurement (CEMO) ved Universitet i Oslo (senere kalt virksomheten)

1. Grunnlag

Viser til virksomhetens søknad datert 05.12.2019 vedrørende utlevering av taushetsbelagte opplysninger til «The Pupil Survey as a measure of school quality».

2. Hjemmel

Forvaltningsloven § 13 d og Utdanningsdirektoratets vedtak av 17.04.2020 vår ref. 2019/14321-1

3. Vedtak og vilkår

Utdanningsdirektoratet kan utlevere de omsøkte opplysningene til CEMO.

Av hensyn til de registrertes personvern og for å sikre at utlevering av data ikke medfører uforholdsmessig ulempe for andre interesser, er det knyttet følgende vilkår til utleveringen:

- Det taushetsbelagte materialet kan kun benyttes til forskning i samsvar med det oppgitte formålet i prosjektsøknaden.
- Prosjektet skal meldes til CEMOs personvernombud/NSD og opplysningene skal behandles i tråd med gjeldende personvernregelverk og eventuelle vilkår satt i tilrådning fra personvernombud/NSD. Utlevering av data vil gjennomføres når vi har fått kopi av personvernombudets/NSDs uttalelse om prosjektet.
- Taushetsbelagt materiale kan bare gjøres tilgjengelig for Rolf Vegar Olsen (prosjektleder), Sigrid Blømeke (senterleder), og studentene (prosjektdeltakere) som er involvert i forskningsprosjektet. Dataene vil gjøres tilgjengelig til maksimalt 4 studenter (en student per delprosjekt). Datamaterialet kan ikke utleveres til andre.
- Vi ber om at CEMO oversender en liste med navn på studentene som skal ha tilgang til dataene. Utlevering av data vil gjennomføres når vi har fått denne listen av CEMO.
- Ved bytte av personer underveis i prosjektet, skal prosjektleder kontakte Utdanningsdirektoratet og levere oppdatert liste over prosjektdeltakere. Byttes prosjektleder, skal Utdanningsdirektoratet få beskjed om dette.
- Personer som får tilgang til taushetsbelagt materiale må underskrive taushetserklæring.
- Alle indirekte identifiserbare data lagres på den måten personvernombudet/NSD anbefaler, og skal kun bli gjort tilgjengelig for prosjektleder og prosjektdeltakere.
- Prosjektleder hos CEMO er ansvarlig for å begrense faren for indirekte identifisering og at elevene kun får tilgang til de dataene de har behov for i sine delprosjekter. Dette innebærer blant annet at skoler under en viss størrelse blir slettet fra filen som utleveres til studentene, samt at Skole-ID fjernes for de delprosjektene der dette ikke er relevant.

1

Dokumentet er signert digitalt av:

- ROLF VEGAR OLSEN (25046823934), 21.04.2020

Forseglet av



Posten Norge

- Eventuelle rapporter og publikasjoner må utgis i en slik form at enkeltpersoner ikke kan identifiseres, verken direkte eller indirekte.
- Dokumentasjon om internkontroll og sikkerhet ved behandlingen av personopplysninger etter personvernforordningen art. 24 og art. 32 skal på forespørsel utleveres til Utdanningsdirektoratet.
- Personidentifiserbare data slettes straks det ikke er behov for dem og senest ved prosjektets avslutning den 01.06.2023. Sletting skal bekreftes av prosjektleder Rolf Vegar Olsen.

4. Ansvar

Utdanningsdirektoratet er ikke ansvarlig for konklusjoner som trekkes av virksomheten eller andre brukere på grunnlag av de leverte opplysninger.

5. Sletting

Virksomheten forplikter seg til å slette alle mottatte taushetsbelagte opplysninger når det ikke lengre er behov for opplysningene og senest innen fastsatt dato. Hvis slik dato ikke er fastsatt skal opplysningene slettes når prosjektperioden er avsluttet. Sletting skal bekreftes av oppdragsansvarlig på vedlagte skjema.

6. Autorisasjon

Følgende personer i virksomheten skal ha tilgang til opplysningene:

1. Rolf Vegar Olsen (prosjektleder)
2. Sigrid Blømeke (senterleder)

Dataene vil i tillegg gjøres tilgjengelig til maksimalt 4 studenter. Vi ber om at CEMO oversender en liste med navn på studentene som skal ha tilgang til dataene. Utlevering av data vil gjennomføres når vi har fått denne listen av CEMO.

Ved endring av personer som skal ha tilgang til opplysningene, skal Utdanningsdirektoratet varsles skriftlig før tilgang gis.

7. Undertegning

Dokumentet er godkjent og signert elektronisk.

Oslo, den 21.04.2020

For Utdanningsdirektoratet:
Ida Erstad, fungerende
avdelingsdirektør

For virksomheten:
Rolf Vegar Olsen, prosjektleder



Confidentiality Agreement



Taushetserklæring

"The Pupil Survey as a measure of school quality"

Saksnummer: 2019/14321-1

Jeg forstår at

- jeg i mitt arbeid kan få kjennskap til forhold som er taushetsbelagte i medhold av lov eller forskrift
- jeg har taushetsplikt når det gjelder informasjon om noens personlige forhold og/eller forretningshemmeligheter som jeg får kjennskap til gjennom mitt arbeid, jf. forvaltningsloven § 13 første ledd nr. 1 og 2
- forvaltningsloven § 13 e om forskeres taushetsplikt gjelder for de opplysninger jeg får utlevert etter utleveringsavtalen
- jeg i mitt arbeid kan få kjennskap til forhold som må behandles strengt konfidensielt, for eksempel eksamensoppgaver, nasjonale prøver, budsjettopplysninger og datasikkerhet
- taushetsplikten også gjelder etter at mitt arbeid tilknyttet Centre of Educational Measurement (CEMO) ved Universitet i Oslo er avsluttet jf. forvaltningsloven § 13 tredje ledd
- brudd på taushetsplikten og misbruk av informasjon jeg får kunnskap om kan medføre straffeansvar jf. straffeloven kapittel 21
- brudd på plikten til konfidensialitet kan medføre erstatningsansvar for Utdanningsdirektoratets økonomiske tap som følge av bruddet
- brudd på taushetsplikt eller plikt til konfidensialitet kan medføre at kontrakten med Utdanningsdirektoratet opphører med øyeblikkelig virkning

Jeg forplikter meg til å

- overholde den taushetsplikten som følger av lov eller forskrift
- overholde plikten til konfidensialitet for opplysninger som kan påføre Utdanningsdirektoratet økonomisk tap og/eller sikkerhetsbrudd
- opptre i tråd med lojalitetsplikten til Utdanningsdirektoratet og utvise varsomhet med behandlingen av opplysninger om direktoratet mv, herunder ikke gjøre slike opplysninger tilgjengelig for utenforstående uten samtykke fra direktoratet
- vise aktsomhet i behandlingen av alle opplysninger, og arbeide i samsvar med eventuelle vilkår fastsatt av Utdanningsdirektoratet
- ikke å gi opplysninger videre til personer i eller utenfor Centre of Educational Measurement (CEMO) ved Universitet i Oslo, og som ikke er nevnt i utleveringsavtalen

Denne taushetserklæring skal underskrives av de personer i virksomheten som er navngitt i "Avtale om utlevering av taushetsbelagte opplysninger til bruk i forskning" og som skal ha tilgang til opplysningene. Erklæringen er undertegnet i to eksemplarer, hvorav underskriver og Utdanningsdirektoratet beholder hver sitt eksemplar.



Jeg har satt meg inn i de lov- og forskriftsbestemmelsene som det er vist til over. Taushetsklæring er lest og akseptert:

Navn (bruk blokkskrift) EBENEZER KNAME KYEKEH	Forskningsinstitusjon (bruk blokkskrift)
Underskrift 	Sted og dato Oslo, 06.08.2021

Navn (bruk blokkskrift)	Forskningsinstitusjon (bruk blokkskrift)
Underskrift	Sted og dato

Navn (bruk blokkskrift)	Forskningsinstitusjon (bruk blokkskrift)
Underskrift	Sted og dato

Navn (bruk blokkskrift)	Forskningsinstitusjon (bruk blokkskrift)
Underskrift	Sted og dato

Navn (bruk blokkskrift)	Forskningsinstitusjon (bruk blokkskrift)
Underskrift	Sted og dato

Appendix II

Data Management and Analysis code

```
##MAE thesis 2022

##Pupils' perception of the learning environment and well-
being: A validation study of the Norwegian Pupil Survey

#Loading relevant packages

library(lavaan)

library(plyr)

library(dplyr)

library(tidyverse)

library(haven)

library(data.table)

library(psych)

library(lme4)

library(lmerTest)

#=====

##Importing relevant dataset

File_for_analysis <- read_sav("File for analysis.sav")

data<-File_for_analysis## Full dataset after dropping schools
with fewer populations (less than 10 pupils)

#Subsetting for grade 10 data

data_1010<-data[data$RoleName=="10. trinn" ,]

#Selecting only cases with complete response on the well-being
scale

data_grade10<-data_1010[complete.cases(data_1010[,7:11]),]

write.table(data_grade10, file =
"./data/data_grade10_exported.txt", row.names = FALSE, sep =
"\t", dec = ".")
```

```
data_grade10_exported <-
read.delim("~/data/data_grade10_exported.txt")
data_10<-data_grade10_exported

#Sampling

Sampel_used<-data_10 # Sample used in the study
sample_dropped<-data_1010[!complete.cases(data_1010[,7:11]),]#
Sample not used in the study

# Mean and SD of used sample for common items
## 'Do you enjoy being at school?' Q6832 (well-being)
well_being_item<-round(describe(Sampel_used$Q6832),2)
##'Do you feel that your teachers care about you?' (Teacher
support)
teacher_support_item<-round(describe(Sampel_used$Q6843),2)
##'My parents are interested in what I do at school?' (Home
support)
home_support_item<-round(describe(Sampel_used$Q6839),2)
##'Are you interested in learning at school?' (Motivation)
motivation_item<-round(describe(Sampel_used$Q6834),2)
## 'The adults at my school set understandable expectation for
how pupils should interact' (A safe school environment)
safe_school_item<-round(describe(Sampel_used$Q6878),2)

# Mean and SD of dropped sample for common items
## 'Do you enjoy being at school?' Q6832 (well-being)
well_being_item_dropped<-
round(describe(sample_dropped$Q6832),2)
##'Do you feel that your teachers care about you?' (Teacher
support)
teacher_support_item_dropped<-
round(describe(sample_dropped$Q6843),2)
##'My parents are interested in what I do at school?' (Home
support)
```

```

home_support_item_dropped<-
round(describe(sample_dropped$Q6839),2)

##'Are you interested in learning at school?' (Motivation)

motivation_item_dropped<-
round(describe(sample_dropped$Q6834),2)

## 'The adults at my school set understandable expectation for
how pupils should interact' (A safe school environment)

safe_school_item_dropped<-
round(describe(sample_dropped$Q6878),2)

# Welch Two Sample t-test

t.test(Sampel_used$Q6832,sample_dropped$Q6832)#well-being
t.test(Sampel_used$Q6843,sample_dropped$Q6843)#teacher support
t.test(Sampel_used$Q6839,sample_dropped$Q6839)#home support
t.test(Sampel_used$Q6834,sample_dropped$Q6834)#motivation
t.test(Sampel_used$Q6878,sample_dropped$Q6878)#safe school

##Multi-level (ICC) ##Checking to see if multilevel modelling
was necessary

data_10$Well_being<-apply(data_10[,7:11],1, mean,na.rm=TRUE)
null_icc<-lmer(Well_being ~ 1 + (1|ASkoleID), data= data_10)
summary(null_icc)
performance::icc(null_icc)

##=====DESCRIPTIVE STATISTICS=====

# Number of boys and girls in the sample

table(Sampel_used$Q6934)

data_10<-Sampel_used

#*****Teacher_support*****

desc_table_teacher_support<-round(
describe(data_10[c(21:24,26)]),2)

desc_table_teacher_support<-
as.data.frame(desc_table_teacher_support)

```

```
desc_table_teacher_support<-desc_table_teacher_support[, -
c(6,7,8,9,10,13)]# subsetting for variables of interest
##Inter-item correlation
corr_teacher_support<-round(cor(data_10[,c(21:24,26)],use =
'pairwise.complete.obs'),2)
corr_teacher_support<-as.data.frame(corr_teacher_support)
#====coefficient alpha=====
psych::alpha(data_10[,c(21:24,26)],na.rm=TRUE)

#*****Well-being*****
desc_table_wellbeing<-round( describe(data_10[7:11]),3)
desc_table_wellbeing<-as.data.frame(desc_table_wellbeing)
desc_table_wellbeing<-desc_table_wellbeing[, -
c(6,7,8,9,10,13)]# subsetting for variables of interest
##Inter-item correlation
corr_wellbeing<-round(cor(data_10[,7:11]),2)
corr_wellbeing<-as.data.frame(corr_wellbeing)
#====coefficient alpha=====
psych::alpha(data_10[7:11],na.rm=TRUE)

#*****Home support*****
desc_table_home_school<-round( describe(data_10[17:19]),2)
desc_table_home_school<-as.data.frame(desc_table_home_school)
desc_table_home_school<-desc_table_home_school[, -
c(6,7,8,9,10,13)]# subsetting for variables of interest
##Inter-item correlation
corr_home_school<-round(cor(data_10[,17:19], use =
'pairwise.complete.obs'),2)
corr_home_school<-as.data.frame(corr_home_school)
#====coefficient alpha=====
psych::alpha(data_10[,17:19],na.rm=TRUE)
```



```
#####Motivation #####
desc_table_motivation<-round( describe(data_10[12:14]),2)
desc_table_motivation<-as.data.frame(desc_table_motivation)
desc_table_motivation<-desc_table_motivation[,-
c(6,7,8,9,10,13)]# subsetting for variables of interest
##Inter-item correlation
corr_motivation<-round(cor(data_10[,12:14], use =
'pairwise.complete.obs'),2)
corr_motivation<-as.data.frame(corr_motivation)
#====coefficient alpha=====
psych::alpha(data_10[12:14],na.rm=TRUE)

#####A safe school environment#####
desc_table_safe_school<-round(
describe(data_10[c(62,64,135:136)]),2)
desc_table_safe_school<-as.data.frame(desc_table_safe_school)
desc_table_safe_school<-desc_table_safe_school[,-
c(6,7,8,9,10,13)]# subsetting for variables of interest
##Inter-item correlation
corr_safe_school<-round(cor(data_10[,c(62,64,135:136)], use =
'pairwise.complete.obs'),2)
corr_safe_school<-as.data.frame(corr_safe_school)
#====coefficient alpha=====
psych::alpha(data_10[,c(62,64,135:136)],na.rm=TRUE)

##=====constructs=====
data_10$Well_being<-apply(data_10[,7:11],1, mean,na.rm=TRUE)
data_10$Teacher_support<-apply(data_10[,c(21:24,26)],1,
mean,na.rm=TRUE)
data_10$Home_school<-apply(data_10[,17:19],1, mean,na.rm=TRUE)
data_10$Motivation<-apply(data_10[,12:14],1, mean,na.rm=TRUE)
data_10$safe_school<-apply(data_10[,c(62,64, 135:136)],1,
mean,na.rm=TRUE)
```

```

desc_table_variables<-round( describe(data_10[294:298]),2)
desc_table_variables<-desc_table_variables[,-c(6:10,13)]
#inter-construct correlation
corr_desc_table_variables<- round(cor (data_10[294:298],
use="pairwise.complete.obs"),2)
corr_desc_table_variables<-
as.data.frame(corr_desc_table_variables)
#Correlation test
corr_data_10<-data_10[,294:298]
cor.test(corr_data_10$Well_being,corr_data_10$Home_school,method =
"pearson", use = "pairwise.complete.obs")
cor.test(corr_data_10$Well_being,corr_data_10$Teacher_support,
method = "pearson", use = "pairwise.complete.obs")
cor.test(corr_data_10$Well_being,corr_data_10$Motivation,method =
"pearson", use = "pairwise.complete.obs")
cor.test(corr_data_10$Well_being,corr_data_10$safe_school,method =
"pearson", use = "pairwise.complete.obs")
cor.test(corr_data_10$Teacher_support,corr_data_10$Home_school
,method = "pearson", use = "pairwise.complete.obs")
cor.test(corr_data_10$Teacher_support,corr_data_10$Motivation,
method = "pearson", use = "pairwise.complete.obs")
cor.test(corr_data_10$Teacher_support,corr_data_10$safe_school
,method = "pearson", use = "pairwise.complete.obs")
cor.test(corr_data_10$Home_school,corr_data_10$Motivation,method =
"pearson", use = "pairwise.complete.obs")
cor.test(corr_data_10$Home_school,corr_data_10$safe_school,method =
"pearson", use = "pairwise.complete.obs")
cor.test(corr_data_10$Motivation,corr_data_10$safe_school,method =
"pearson", use = "pairwise.complete.obs")

write.table(corr_desc_table_variables, file =
"./data/corr_desc_table_variables.txt", row.names = FALSE, sep
= "\t", dec = ".")

#Confirmatory Factor Analysis (Step 1)
#=====Well-being =====

```

```
## the items that had order as frequency were viewed as the
same method and were correlated

## frequency vs degree

## Model Specification

modell<-"Wellbeing=~ Q6832 + Q6833 + Q6936 + Q6937 +Q6938 ##
model 1

"

modell1<-"Wellbeing=~ Q6832 + Q6833 + Q6936 + Q6937 +Q6938 ##
Model 2

Q6832~~Q6936 + Q6937
Q6833~~Q6938"

#Model estimation

model_well_being1<-cfa(modell,data = data_10, missing="ML")
model_well_being11<-cfa(modell1,data = data_10,missing="ML")

#Model comparison

anova(model_well_being1,model_well_being11)

#Model fit evaluation

fitmeasures(model_well_being1,c("chisq","df","pvalue","rmsea",
"gfi","aic","bic", "cfi","srmr", "tli"))

fitmeasures(model_well_being11,c("chisq","df","pvalue","rmsea"
,"gfi","aic","bic", "cfi","srmr", "tli"))

fitmeasures(model_well_being1)

fitmeasures(model_well_being11)

summary(model_well_being1,standardized=TRUE,rsquare=TRUE)
summary(model_well_being11,standardized=TRUE,rsquare=TRUE)
modificationindices(model_well_being1)

#====Support from teachers =====
model2<-"Teacher_Support=~ Q6843 + Q6844 + Q6845 + Q6846+
Q6848 #Model 1

"
```

```

model22<-"Teacher_Support=~ Q6843 + Q6844 + Q6845 + Q6846
+Q6848 # Model 2

Q6846~~Q6848          #similarly worded items
"

#Model estimation

model_teacher_support2<-cfa(model2,data =
data_10,missing="ML") # model 1

model_teacher_support22<-cfa(model22,data =
data_10,missing="ML")# model 2

#Model comparison

anova(model_teacher_support2, model_teacher_support22)

summary(model_teacher_support2,standardized=TRUE,
rsquare=TRUE)

summary(model_teacher_support22,standardized=TRUE,
rsquare=TRUE)

#Model fit evaluation

fitmeasures(model_teacher_support2,c("chisq","df","pvalue","rm
sea","gfi","aic","bic", "cfi","srmr","tli"))

fitmeasures(model_teacher_support22,c("chisq","df","pvalue","r
msea","gfi","aic","bic", "cfi","srmr","tli"))

fitmeasures(model_teacher_support2)

fitmeasures(model_teacher_support22)

modificationindices(model_teacher_support)

#====Home support =====

#Model specification

model3<-"Home_School=~ Q6839 + Q6840 + Q6841 # Saturated model
"

#Model estimation

model_home_school<-cfa(model3,data = data_10)

summary(model_home_school,standardized=TRUE, rsquare=TRUE)

#====Motivation=====

```

```

model4<-"motivation=~ Q6834 + Q6835 + Q6836 #saturated model (
Just identified)
"
#Model estimation
model_motivation<-cfa(model4,data = data_10,missing="ML")
summary(model_motivation,standardized=TRUE,rsquare=TRUE)

#====A safe school environment =====
#The underlying orders were correlated as methods
model5<-"Safe_school=~ Q6876 + Q6877 + Q6878 + Q6880 #Model
1
"
model55<-"Safe_school=~ Q6877 + Q6876+ Q6878 + Q6880 #Model
2
Q6876~~Q6877"
#Model estimation
model_safe_school5<-cfa(model5,data = data_10,missing="ML")
model_safe_school55<-cfa(model55,data = data_10,missing="ML")
fitmeasures(model_safe_school55)
#Model comparison
anova(model_safe_school5,model_safe_school55)

#Model fit evaluation
fitmeasures(model_safe_school5,c("chisq","df","pvalue","rmsea"
,"gfi","aic","bic", "cfi","srmr","tli"))
fitmeasures(model_safe_school55,c("chisq","df","pvalue","rmsea
","gfi","aic","bic", "cfi","srmr","tli"))
fitmeasures(model_safe_school5)
fitmeasures(model_safe_school55)
summary(model_safe_school55,standardized=TRUE)
modificationindices(model_safe_school)

```

```

#=====Step 2=====
##=====SEM REGRESSION=====

#==Full model SEM regression (Measurement + Structural part)==
Sem1<- ##measurement models
      'Wellbeing=~ Q6832 + Q6833 + Q6936 + Q6937 +Q6938
Q6832~~Q6936 + Q6937
Q6833~~Q6938
Teacher_Support=~ Q6843 + Q6844 + Q6845 + Q6846 +Q6848
Q6846~~Q6848
Home_School=~ Q6839 + Q6840 + Q6841
motivation=~ Q6834 + Q6835 + Q6836
Safe_School=~ Q6877 + Q6876+ Q6878 + Q6880
Q6876~~Q6877
##Structural part
Wellbeing~ b1*motivation +b2*Safe_School + c1*Teacher_Support
+ c2*Home_School
motivation~ a1*Teacher_Support +a2*Home_School
Safe_School~ a3*Teacher_Support + a4*Home_School
#Covariances
Teacher_Support ~~ Home_School
#Indirect and total effects
ind11:=a1*b1
ind12:=a3*b2
ind21:=a2*b1
ind22:=a4*b2
tot1:=ind11+ind12+c1
tot2:=ind21+ind22+c2
'
#Model estimation

```

```
fit.sem<-sem(Sem1,data=data_10,estimator="MLR",missing="ML")
#robust maximum likelihood estimator

standardizedSolution(fit.sem)

summary(fit.sem, standardized=TRUE, rsquare=TRUE)

##Model fit evaluation

fitmeasures(fit.sem,c("chisq","df","pvalue","rmsea","gfi","aic",
", "bic", "cfi","srmr","tli"))

fitmeasures(fit.sem)

##=====Test for indirect effect with bootstrap
standard errors

#Set seed

set.seed(616)

#Model estimation

fit.sem.boot<-sem(Sem1,data = data_10,
se="bootstrap",bootstrap=2000)

#Summarize results

summary(fit.sem.boot,standardized=TRUE, rsquare=TRUE)

parameterestimates(fit.sem.boot,standardized =
TRUE,boot.ci.type = "bca.simple")

standardizedSolution(fit.sem.boot)
```

Appendix III

Supplemental materials

Composite reliability (CR)

The composite reliability is the ratio of the explained variance over total variance.

Drawing on Kline (2016), for factors with no residual correlations between indicators, the CR is estimated as:

$$CR = \frac{\Sigma(\hat{\lambda}_i)^2 \hat{\phi}}{\Sigma(\hat{\lambda}_i)^2 \hat{\phi} + \Sigma\hat{\theta}_{ii}}$$

Where $\Sigma\hat{\lambda}_i$ is the sum of the unstandardized pattern coefficients among indicators of the same factor, $\hat{\phi}$ is the estimated factor variance, and $\Sigma\hat{\theta}_{ii}$ is the sum of the unstandardized error variance.

For factors with at least one error covariance, the CR is estimated as:

$$CR = \frac{\Sigma(\hat{\lambda}_i)^2 \hat{\phi}}{\Sigma(\hat{\lambda}_i)^2 \hat{\phi} + \Sigma\hat{\theta}_{ii} + 2\Sigma\hat{\theta}_{ij}}$$

Where $\Sigma\hat{\theta}_{ij}$ is the sum of the nonzero unstandardized error covariances

Table A1

Summary of deleted cases

Role name	Gender		Total
	Male	Female	
10. trinn	289	247	536
	53.92%	46.08%	100%

Table A2

Results of Welch two-sample t-test

Construct/Indicators	Used sample		Dropped sample		$\bar{X}_1 - \bar{X}_2$	t-statistic	p
	M	SD	M	SD			
<i>Well-being</i>							
Do you enjoy being at school?	4.15	0.81	4.12	0.83	0.03***	2.2726	<.002
<i>Teacher support</i>							
Do you feel that your teachers show they care about you?	3.98	0.84	3.95	0.85	0.03***	2.7484	<.002
<i>Home support</i>							
My parents are interested in what I do at school	4.19	0.95	4.19	0.95	0.00	0.27171	0.786

Motivation

Are you interested in learning at school? 3.87 0.95 3.81 0.94 0.06*** 5.8160 <.002

A safe school environment

The adults at my school set understandable expectation for how pupils should interact? 4.35 0.73 4.34 0.76 0.01 1.2169 0.224

Note. Mean difference $(\bar{X}_1 - \bar{X}_2)$ = Mean of used sample – mean of dropped sample

*** $p < .002$ ($\alpha^{\text{adj}} = .01/5 = .002$; Bonferroni correction)

Table A3*Inter-item correlations (Well-being)*

Item	Inter-item correlations				
	1	2	3	4	5
1. Do enjoy being at school?	-				
2. Do you have any fellow pupils to play with during breaks/free periods?	.46	-			
3. Do you enjoy being with the pupils in your group/class?	.62	.47	-		
4. Do you enjoy breaks/free periods?	.61	.57	.63	-	
5. Do you ever feel lonely at school?	.42	.48	.42	.49	-

Table A4*Inter-item correlations (Teacher support)*

Item	Inter-item correlations				
	1	2	3	4	5
1. Do you feel that your teachers show they care about you?	-				
2. Do you feel that your teachers believe you can do well at school?	.74	-			
3. Do you feel that your teachers treat you with respect?	.69	.68	-		
4. I get help from my teachers when I have problems understanding assignments at school	.60	.59	.61	-	
5. My teachers help me understand what I am intended to learn	.55	.55	.53	.66	-

Table A5*Inter-item correlations (Home support)*

Item	Inter-item correlations		
	1	2	3
1. My parents are interested in what I do at school	-		
2. I get help at home with my homework	.60	-	
3. The adults at home encourage me to do schoolwork	.63	.60	-

Table A6*Inter-item correlations (Motivation)*

Item	Inter-item correlations		
	1	2	3
1. Are you interested in learning at school?	-		
2. How well do you like schoolwork?	0.63	-	
3. I look forward to going to school	0.48	.56	-

Table A7*Inter-item correlations (Safe school)*

Item	Inter-item correlations			
	1	2	3	4
1. The adults at my school set understandable expectations for how pupils should interact	-			
2. Do the adults at your school react when someone says or does something that is not nice or is mean to another pupil?	0.55	-		
3. The adults make sure we follow the rules for how we should behave at school	0.46	0.52	-	
4. The adults at this school are consistent in their reaction when pupils break the rules	0.36	0.46	0.61	-

Table A8*Model fit indexes*

Construct	Model	Chisq	df	RMSEA	SRMR	CFI	TLI	χ^2 diff	$p(\chi^2$ diff)
Well-being	M ₁	613.18	5	.100	.031	.974	.949	594.08	<.001
	M ₂	19.10	2	.026	.005	.999	.996		

Teacher support	M ₁	1445.32	5	.155	.040	.957	.915	1347.1	<.001
	M ₂	98.24	4	.044	.009	.997	.993		
Safe school	M ₁	888.99	2	.194	.047	.939	.817	846.02	<.001
	M ₂	42.97	1	.060	.009	.998	.983		
