Increased School Nurse Resource in Systemic and Structured Collaboration with Norwegian Primary Schools: A Randomised, Controlled Trial

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Abstract

The project ‘Increased School Nurse Resource in Systemic and Structured Collaboration with Norwegian Primary Schools’ is part of a larger research programme financed by the Norwegian Directorate of Education. The main aim of the programme is to investigate how different professionals, working in collaboration with the school staff, may contribute to students’ learning environment and learning outcomes. The present study is a randomised, controlled trial whose principal aim is to explore how an increased school nurse resource working in systemic and structured collaboration with primary schools in 14 Norwegian municipalities may affect 5th to 7th grade students’ psychosocial environment.

1 Introduction

The project ‘Increased School Nurse Resource in Systemic and Structured Collaboration with Norwegian Primary Schools’ is part of a larger research programme financed by the Norwegian Directorate of Education. The main aim of the programme is to investigate how different professionals, working in collaboration with the school staff, may contribute to students’ learning environment and learning outcomes. The present study is a randomised, controlled trial whose principal aim is to investigate how an increased school nurse resource at randomly selected schools in 14 Norwegian municipalities affect the students’ psychosocial environment, and secondarily, their broader learning environment and academic outcomes.

One important background for the programme was the White Paper ‘Time for Learning’ (Meld. St.no. 19, 2009-2010) that explicitly stated that more of teachers' time should be used for teaching. During Parliamentary discussion of the White Paper, the need for other professions in schools was emphasised as a potential mean to relieve teachers from the additional workload. It was argued that schools need capacity and expertise beyond education to accommodate the diverse range of challenges faced by students. Thus, a need for more systematic knowledge on which other professions should be strengthened and how these should work in schools emerged – resulting in a first call with the main aim to review the literature and develop different models for multidisciplinary collaboration to be piloted in Norwegian schools.

The Work Research Institute answered the first call and produced two research reports comprising of a systematic review (Borg, Drange, Fossestøl, & Jarning, 2014) and the development and testing of different models for multi-profession involvement in schools (Borg, Christensen, Fossestøl, & Pålshaugen, 2015). Five models were developed and proposed for further investigations; 1) the ‘Educational and Psychological Counselling Service Model’ emphasising a further strengthening of the existing collaboration between

teachers and counsellors, in a systemic way, 2) the ‘Teacher Assistant Model’ proposing increasing the teacher assistants’ involvement in the ongoing educational activities, 3) the ‘Social Worker Model’ – a model described as somewhat problematic since social workers lack a formal institutional platform and the model competes to some degree with other interventions, 4) the ‘Management and Organizational Model’ focusing on the importance of leadership to clarify the responsibilities for different profession groups working in schools, and finally 5) the ‘School Nurse Model’ emphasising strengthening the collaboration between the school staff and school health service. The latter model was described as having great potential since the school health service is mandatory, there is a political will in Norway for upgrading the school health program, and there is relatively clear understanding of each other's tasks, responsibilities, and roles (for details, see Borg et al., 2015).

In the second call for proposals, the Norwegian Directorate of Education underscored the need for randomised, controlled trials (RCTs) to test the effectiveness of one or more of the models identified by the Work Research Institute. Moreover, the call emphasised specifically the need for more research and interventions targeting students in 5th to 7th grade. These students are10-12 years old and at the threshold to adolescence where they gradually have to take greater responsibility for their own lives and choices. In this phase of identity development, experiences and perceptions at school may be decisive for a vast number of outcomes. Increased knowledge of how collaboration between different professions and schools may affect students’ perceptions and different outcomes were therefore called for. Thus, the present study aims to investigate the proposed ‘School Nurse Model’ and study how an increased school nurse resource working in systemic and structured collaboration with primary schools may affect 5th to 7th grade students’ psychosocial environment. In the project, *systemic collaboration* means that school nurses are involved in the school’s overall work with keeping overview of the health and well-being of the students, including initiating and

implementing universal and preventive measures targeting psychosocial aspects of the learning environment. *Structured collaboration* means that schools and school nurses organise their collaboration by regular meeting/contacts in contrast to collaboration based on irregular and arbitrary contact between schools and the school health services only. Systemic work is described in the revised and recently passed guidelines for the school health service (The Norwegian Directorate for Health, 2017) and the project provides guidelines for the meeting series between the school nurse and staff at schools.

1.1 Previous studies

According to Maughan (2016), previous studies of how school nurses affect students learning environment and learning outcomes are scarce. However, available studies indicate that healthcare workers in schools may positively affect student absence, risk behaviour, and teachers' time devoted to teaching. For instance, a systematic review of Maughan (2003) reveals a positive association between school nurse presence and student absence. Prolonged absence resulted in a significant risk of reduced school performance (Credé, Roch, & Kieszczynka, 2010). Moreover, school nurses have been found to help students stop smoking, lose weight, avoid pregnancy, and improve their mental health, all factors that may influence student learning (Maughan, 2003, 2016).

In their report, Borg et al. (2014) cite some studies exploring healthcare workers in schools. For instance, a study by Baisch, Lundeen, and Murphy (2011) concludes that healthcare workers relieve teachers, thus increasing their time devoted to teaching. The conclusion, however, is based on teachers' ex-post descriptions of the situation before and after an increased schools nurse resource – and the intervention was not randomised. Also, Cappella, Jackson, Bilal, Hamre, and Soulé (2011) studied the interaction between teachers and students with and without learning problems, concluding that school healthcare personnel may be important for students' development when the health workers support and guide the

teachers with regard to such interaction. The authors state that strengthening the interaction between the teacher and student is a primary mechanism of development and learning for both children with behavioural problems and their fellow students.

Finally, Borg et al. (2014) summarise the studies and conclude that school nurses may have a positive effect on students' ability to learn. This is especially true in terms of reduced absence, disease maturation, and empowering students to believe that they themselves can master challenges in everyday life. However, further research that specifically investigate causal relations between school nurse interventions and student perceptions of the learning environment and academic outcomes is called for. Thus, the present study aims to contribute to the knowledge base in this area by investigating possible effects of an increased school nurse resource on psychosocial aspects of the learning environment. Specifically, we will study student emotional well-being, school belonging, bullying, and student attendance as primary outcomes, and more learning-related outcomes such as motivation, academic self-concept, and achievement as well as performance on academic tests as secondary outcomes. In the next section, we present a theoretical model of hypothesised relations guiding the study. As previous studies on effects of school nurse interventions and student outcomes are scarce, we partly use theoretical frameworks from education research to inform our theoretical rationale and expectations.

1.2 Objectives and theoretical model

The overall objective is to study the effect of an increased school nurse resource in systemic and structured collaboration on primary school students' psychosocial environment, and secondarily, their broader learning environment and academic outcomes. The study is guided by the theoretical model presented in Figure 1. The figure illustrates how the intervention is hypothesised to affect outcomes on three different levels: the student level, the teacher level, and the school level. The figure also shows which sources of data that will inform the effect

evaluation and the implementation and process evaluation, respectively. Note that a more thorough description of the intervention, the implementation and process evaluation, and the primary and secondary outcomes and how they are measured, are provided later in this protocol.

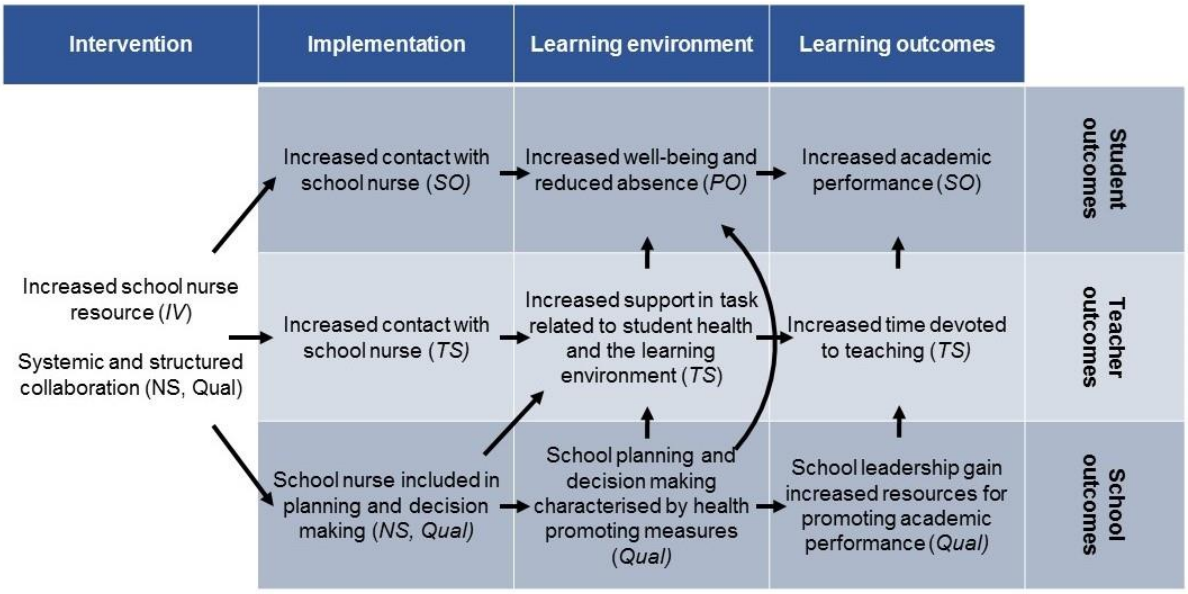

Figure 1: Theoretical model. PO and SO indicate primary and secondary outcomes, IV indicates instrumented variable, TS, NS and PS indicates surveys to teachers, nurses and principals, Qual indicate qualitative interviews.

At the student level, one secondary outcome is to what degree the students at the treatment schools perceive increased availability of the school nurse due to the increased resource. We will use this measure in both the study of implementation and effect, and is hypothesised to be a possible mediating factor.

The primary outcome in the effect study is students' psychosocial environment, measured as their sense of emotional well-being in school, school belonging, bullying, and registered absence. Students' sense of well-being in school in the form of positive academic emotions is found to be related to better motivation and academic results (Mega, Ronconi, & De Beni, 2014). Other research indicates that school belonging and positive teacher-student

relations are predictive of student engagement, and achievement (e.g. Cornelius-White, 2007; Danielsen, Samdal, Hetland, & Wold, 2009; Federici & Skaalvik, 2014a; Roorda, Koomen, Spilt, & Oort, 2011; Wang & Holcombe, 2010). Thus, the school nurse could reduce the time that the teacher spends on health issues among students (Baisch et al., 2011), allowing the teacher to focus more on creating learning enhancing relationships with the students and teaching. Moreover, the school nurse may also help identify students who find social relationships at school difficult, and cooperate with the educational staff to enhance the social inclusion of students. Involvement in the prevention of bullying and rehabilitation of students that have been exposed to bullying is suggested to be a particularly important role for school nurses (Tharaldsen, Slåtten, Hancock, Bru, & Breivik, 2017). Research suggests that exposure to bullying could seriously impede academic achievement (Bru & Hancock, 2017). Therefore, if the school nurse could help the school become more effective in preventing bullying and alleviating the negative consequences of being exposed to bullying, this could improve well-being and academic achievements among students. Finally, a previous Norwegian study found that school absence only to a limited extent can be traced to somatic illness (Havik, Bru, & Ertesvåg, 2015). Absence from school is a risk factor for lower academic achievements (Credé et al., 2010). The school nurse could play an important role regarding knowledge about and attitudes towards reason for absence. The school nurse could also help identify students with worrisome absence and help them increase their attendance. In this way, the school nurse could also contribute to enhancing academic achievements among students (Weismuller, Grasska, Alexander, White, & Kramer, 2007)

To understand how the intervention affects the students, it is also important to understand whether the increased school nurse resource is used in a systemic and structured way. The collaboration will be assessed both from the school nurses', the teachers', and the school administration's points of view. Moreover, we hypothesise that the quality of

implementation is decisive for the degree to which an increased school nurse resource affects the students learning environment and academic outcomes. Thus, one important aspect of the implementation and process evaluation consists of teachers' perceptions of school nurse availability and support in tasks related to students' health and psychosocial environment. As indicated in Figure 1, we will also study to what degree teachers perceive that more time may be devoted to teaching during the intervention.

The outcomes at school level are all related to the implementation and process evaluation. We will ask nurses and school leaders at both the treatment schools and control schools to what degree the school nurses are included in planning and decision making related to student health and the psychosocial learning environment. In addition, important aspects of the implementation and process evaluation are to explore concepts such as fidelity and dosage. That is, the extent to which the school nurses adhere to the intervention and to what degree the additional resource is used at the treatment schools. Finally, qualitative interviews will be conducted with school leaders, school health nurses, heads of education and health departments at municipality level, as well as group interviews with grade 5 to 7 teachers and the Parents Working Committees at selected intervention and control schools. One aim will be to explore aspects of implementation, for instance to what degree planning and decision making in schools takes health-promoting aspects into account and to what degree the schools perceive that the extra resource alleviates tasks from other staff members which can be used for promoting academic performance. A summary of the trial describing inputs, activities, outputs, and impact are shown in table A1 (Appendix 1).

2 Trial design

The project 'Increased School Nurse Resource in Systemic and Structured Collaboration with Norwegian Primary Schools' is a cluster-randomised controlled trial where four schools in each of 14 municipalities are randomly selected to receive a 12.5% position increased school

nurse resource from January 2018 to December 2019. The school nurse should work in a structured and systemic collaboration with the school and the resource should target 5th – 7th grade. The main hypothesis is that an increased nurse-to-student ratio will improve students self-reported measures related to psychosocial aspects of the learning environment and reduce student absence.

2.1 Participants

The participants in the present study comprise of approx. 11.000 grade 5-7 students from 14, not randomly selected municipalities. To be invited, the municipality had to have at least eight primary schools with a total of 20 students in grade 5 to 7 (we used the GSI database (www.gsi.udir.no) to obtain these data). Municipalities engaged in other large NIFU projects[1] at the relevant point of time or who participated in the other 'Team around the Student' project ('Improving inter-professional collaboration in Norwegian primary schools', conducted by the Work Research Institute[2]) were excluded to avoid contamination from other interventions. A total of 31 municipalities were invited based on the predefined inclusion/exclusion criteria (see flow diagram in chapter 3) and a total of 14 municipalities responded positively to the invitation. Random assignment was conducted after the agreement of collaboration was signed by the participating municipalities.

Table 1 shows the number of schools and students in grade 5 to 7 participating within each municipality based on the municipalities' own estimates for the school year 2017-2018. The surveyed student population will be repeated cross-sections of the students in the target group at each point in time. Note that schools within each municipality with less than 20

[1] For instance, the 'Small group Instruction in Mathematics for Pupils Level 1-4'. See http://1pluss1prosjektet.no/frontpage

[2] Protocol available at https://clinicaltrials.gov/ct2/show/study/NCT03248245?term=54470&rank=1#contacts

students were not invited and are thus not included in the table. Moreover, some of the participating schools are private. These schools partake in the same school health services as public schools. However, private schools are not subordinates of the municipal authority. Thus, we contacted the headmaster/head of administration at each school and invited them to participate in the project. Only one private school declined.

Table 1: Participants in the present study

Municipality	County	Participating schools	Number of students 5-7
Eidsvoll	Akershus	8	916
Grimstad	Aust-Agder	9	903
Klepp	Rogaland	7*	797
Kvinnherad	Hordaland	10	495
Lindås	Hordaland	9	601
Melhus	Sør-Trøndelag	9	667
Nes	Akershus	8	723
Porsgrunn	Telemark	13	1220
Rana	Nordland	9	852
Stjørdal	Nord-Trøndelag	9	877
Østre Toten	Oppland	8	462
Alta	Finnmark	9	776
Gran	Oppland	7	474
Ski	Østfold	8	1342
Total	14	123	11 105

*In Klepp, 5th and 6th grade attend Bore primary school and 7th grade attend Bore secondary school. The two schools are treated as one in the trial.

Regardless of the total number of participating schools within each municipal authority, four schools were randomly assigned to the treatment group with the rest of the schools assigned to the control group (for details see chapter 3, Randomisation).

2.2 Intervention

The *dosage* in the project comprises of a 50 percent position increase in each participating municipality's school health service. More specifically, the additional resource is to be used to increase the presence of the school health service at the four schools in the treatment group.

This comprises of a 12.5 percent position additional availability of the school nurse at each school – targeting the students in 5th, 6th and 7th grade.

The additional school nurse resource should provide services in line with the revised and recently passed guidelines for the school health service (The Norwegian Directorate for Health, 2017). These guidelines highlight that the school health service should work systemic and in structured collaboration with the staff at school. The school nurse should collaborate with the schools in getting overview of the student population's health and well-being, and identify possible areas where the school nurse could contribute with measures regarding health-related issues, prevention, and measures for all students or groups of students in 5th to 7th grade with an emphasis on improving the students' psychosocial environment. Thus, systemic means working in a universal and preventive manner with psychosocial aspects of the learning environment.

Research reports indicate that there is a lack of a clear theoretical conceptualisation of the construct of 'systemic' in the Norwegian school context (Bliksvær, Hannås, Hustad, & Strømsvik, 2015; Hustad, Strøm, & Strømsvik, 2013). Hustad et al. (2013) propose, based on evaluations of the Norwegian Educational and Psychological Counselling Service, to distinguish between three meanings of systemic depending on the system level at which the professional operates. First, systemic may mean work conducted within the children and adolescents' psychosocial environment, i.e. the social system which the students are a part of. Interventions at this level may concern individuals, groups, or classes. However, these interventions should to a large degree be beneficial for the whole student population and include common goals, coordinated efforts and collaboration between the school health service and school staff. The second meaning is systemic work understood as conducted within the school as an organisational system. With this meaning, the school health service should contribute on a more strategic basis, for instance by initiating school-wide preventive

measures or by introducing programs for reducing bullying. Finally, a third understanding sees systemic work as interacting with other public services related to the school. At this level, the school health service may, for instance, have a coordinating role for collaboration with municipal and national public services and other agencies. In the present study, the additional school nurse resource may contribute and act on all these three levels.

In addition to collaborate with the school staff in a systemic way and in accordance with the guidelines, the intervention is also structured by a set of criteria. That is, the municipal authority should have a plan for how to organise the additional resource, the schools should have plans for how frequently the meetings will take place and what will be discussed, and how measures are followed up. Although the municipal authority, the schools, and the school health service are given local autonomy, some structure is prerequisite for being able to work systemically and for collaboration not to solely rely on individual arrangements. The criteria (principles), inputs, and other activities will be presented in the following.

2.2.1 Principles for the additional resource

During the intervention period the municipalities, and thus the school health service and the treatment schools, are admitted to the following principles in how to use the additional school nurse resource:

1) The treatment schools must receive at least 3.25 additional hours per week with present school health service targeting the students. A maximum of 3.25 hours per week may be devoted to administrative tasks (out of school meetings, courses, etc.). If administrative time is not needed, the time should be used at the treatment schools.
2) The increased school nurse resource must be organised in a way that avoids excessive splitting up of the service on multiple nurses within each school. One school nurse can cover a maximum of two treatment schools.

3) The increased school nurse resource must be organised in a way that enables the school nurse to work systemically and structured. Plans and measures must be aimed at students in 5th to 7th grade and should not result in increased segregation of students.
4) The increased school nurse resource must work in accordance with the guidelines for the school health service. As previously mentioned, the guideline underscore that the school health service should work systemically and in structured collaboration with the schools. Moreover, it consists of descriptions of different tasks and themes that the school nurse should be involved in. The intervention should focus on themes and tasks related to the student psychosocial environment.
5) The increased school nurse resource should identify specific health promoting and preventive measures that promote the students' psychosocial environment at each treatment school. Important sources for identification and knowledge are the headmaster, teachers, other staff, the students, and the school nurse herself. Also, at the initial meeting between the school and the additional school nurse a fact sheet will be provided consisting of data from the Norwegian Pupil Survey (concerning the students learning environment) and a synthesis of the guidelines for the school health service.

2.2.2 Workshop, initial meeting, and meeting series

The school health service, the school nurses and headmasters at the treatment schools, and the municipal authority have been invited to a two-day workshop in the beginning of the project (January 2018). The workshop is arranged by the research consortium and comprises of introductions, presentations, group tasks, and discussions. It is also an arena for sharing plans and experiences between the municipalities. During the workshop, the researchers will present a guide consisting of state-of-the-art research concerning different aspects of students' learning environment. The guide is produced by the research consortium and may provide tips and ideas regarding how to work systemic and structured with the student psychosocial

environment. Note that the workshop does not include any courses or presentations that may be regarded as formal education.

Also at the workshop, the researchers will present some guidelines for the initial meeting and further meeting series between the school nurse and staff at the treatment schools (e.g. headmaster, teachers on 5th to 7th grade, students, and other social-pedagogical professions). The headmaster at each treatment school is responsible for initiating the first meeting. The purpose is to get an overview and a common understanding of the students in 5th to 7th grade well-being and identify factors contributing or preventing the development of a positive psychosocial environment. Furthermore, key measures to improve the students learning environment to which the school nurse will contribute must be developed and reported to the researchers. A plan for further meetings is decided upon by the participants, and meetings should be carried out at least three times each semester. At these meetings, the participants should follow up proposed measures, discuss the need for changes in measures, or develop and implement new measures.

To summarise, the school nurse and the staff at the treatments schools have extensive autonomy to decide upon how to use the additional resource, as long the measures are systemic and the collaboration is structured, and the resource is used in line with the principles and guidelines presented above.

2.3 Implementation and process evaluation

The study of effect will be accompanied by a thorough implementation and process evaluation (IPE). IPE refers to the generation and analysis of data to examine how the intervention is put into practice, how it operates to achieve its intended outcomes, and the factors that influence these processes (Humphrey et al., 2015). In the present study, the IPE will be informed by both quantitative and qualitative data.

To investigate whether the nurses have spent the right amount of time in each school, we employ a time registration survey to all nurses working in primary schools within each participating municipality. The survey is distributed to all school nurses once every four weeks and they are asked to report time use and activities for the following week. In addition, surveys will be distributed two times a year during the project period to the headmasters, teachers, and the school nurses. The aims of these surveys are twofold: Firstly, it will explore to what degree the involved actors perceive that they work in a systemically and structured manner. Secondly, it will explore to what degree the guidelines are being followed and whether the school nurses are included in planning and decision-making at schools. To complement these surveys, all treatment schools must provide the researchers with a report from both the initial meeting and the following meetings. Finally, qualitative interviews will be conducted with representatives from the school, the municipal authority, the school health service, grade 5 – 7 teachers and Parents Working Committees at both intervention and control schools.

2.4 Study of effect – outcomes

The primary and secondary outcomes of the effect study are comprised of both subjective and objective measures. The subjective measures are students' perceptions of psychological and social dimensions related to the psychosocial aspects of the learning environment whereas the objective measures are student attendance (causes of student absence may be psychological, social, and/or physical) and student achievement (cognitive dimension) – the latter measured as results on the Norwegian National Tests.

Our categorisation of the outcomes are inspired by the framework used in PISA for measuring student well-being (for details, see OECD, 2017). OECD (2017) defines well-being as a multi-dimensional construct comprising of psychological, social, cognitive, and physical dimensions which together are indicative of students functioning and well-being

(Borgonovi & Pál, 2016). These dimensions are all influenced by students' proximal context, such as the school learning environment. In their report, the psychological dimension of students' well-being is described as students' sense of purpose in life, self-awareness, affective states, and emotional strength. These perceptions are in turn supported by self-esteem and motivation, and hindered by anxiety and stress. The social dimension refers to students' social lives and includes aspects such as relationships with family, peers, and teachers, as well as exposure to bullying. The cognitive dimension of students' well-being refers to the cognitive foundation students need to participate fully in society. In PISA 2015, this dimension is measured as students' achievement across the PISA domains. Finally, the physical dimension refers to students' health. PISA do not measure students' health directly but provide self-reports on physical activity and eating habits (OECD, 2017).

As with conceptualizations of student well-being, definitions of the school learning environment (and school climate) often indicate a multidimensional structure of the construct. For instance, Cohen, McCabe, Michelli, and Pickeral (2009) define a learning environment as '*the quality and character of school life. School climate is based on patterns of people's experiences of school life and reflects norms, goals, values, interpersonal relationships, teaching and learning practices, and organizational structures*' (pp. 182). Such a definition indicate that students' perceptions of the learning environment should be captured by several indicators covering different domains. Thus, we adopt a similar categorisation as the OECD framework when measuring subjective and objective aspects of students' self-perceptions related to the learning environment at school. Together these measures cover different aspects of the students learning environment.

2.4.1 Measuring the outcomes

The subjective measures of learning environment are measured by the Norwegian Pupil Survey. This survey is administrated by the Norwegian Directorate for Education and

Training (see https://www.udir.no/in-english/) and administered twice each school year (autumn and spring). It is compulsory in the autumn for 7th, 10th, and 11th grade. However, all schools with students from 5th to 13th grade are encouraged to include all grades in the survey and the decision whether to participate or not is usually taken at the municipal level or school level. The total number of respondents in the autumn 2016 amounted to 431 778 students which constitutes approximately 76.8% of the total population (Wendelborg, 2017). The number of respondents for grades 5th to 7th are shown in table 2.

Table 2: Response rate, the Norwegian Pupil Survey 2016

Grade	N	Percent of population
5th grade	38,532	60.9
6th grade	42,392	68.5
7th grade	56,749	91.3

The survey consists of both compulsory questions that vary between the levels (e.g., upper primary level, lower secondary level, and upper secondary level) and optional questions. In the present study, we will use both compulsory measures, optional questions, and additional questions. The compulsory measures have been utilised since the last revision of the Norwegian Pupil Survey in 2012 and been subjected to both exploratory and partly confirmatory factor analyses (Federici, Caspersen, & Wendelborg, 2016; Federici & Wendelborg, 2013; Wendelborg, Røe, & Federici, 2014). Regarding the additional questions, we use previously validated measures and single items developed for the study. The scales and items are presented in tables 2 to 7. Note that the survey is administrated in Norwegian, thus the presentation of the items represents translations into English.

2.4.2 Primary outcomes

The four primary outcomes measure a psychological dimension of well-being, a social dimension, and student absence. The social dimension comprises of two subdimensions. Each dimension is connected to a number of secondary outcomes as well (see 2.4.3).

The *psychological dimension* comprises of students' perceived *emotional well-being* at school and focuses on affective states and emotional responses in class during the last week. The measures are inspired by the *core affect scale* developed by Russell (2003), however, we use a short version consisting of five items comprising of both positive and negative affect. A similar short version has been employed in previous studies such as in the Children's World survey (Rees & Main, 2015) and has successfully been administered to Norwegian 5th to 7th graders in the Ungdata Junior project. In the present study, responses are given on a five-point Likert scale ranging from 'never' (1) to 'always' (5). In our analyses, the scale will be used as a composite measure indicative of students' emotional well-being. Note that the measure has been subjected to quantitative and qualitative piloting with students in 5th and 6th grade. Moreover, the initial analyses will include confirmatory factor analyses to ensure scale reliability and validity. Items that do not reach statistical significance and other measures of goodness of fit statistics such CFI, IFI, TLI, RMSEA (Hoyle, 2012; Kline, 2011; Tabachnick & Fidell, 2007) in baseline data will be excluded. For the CFI, IFI, and TLI indices, values above .90 are typically considered as acceptable, whereas values greater than .95 indicate a good fit (Hoyle, 2012; Hu & Bentler, 1999; Kline, 2011). For well-specified models, an RMSEA of .06 or less reflects a good fit (Byrne, 2010; Tabachnick & Fidell, 2007).

The *social dimension* comprises of school belonging (or relatedness) and bullying. OECD defines a sense of belonging as a feeling of acceptance and being liked by the rest of the group, feeling connected to others and feeling like a member of a community (Baumeister & Leary, 1995; OECD, 2017). School belonging is measured using six trend items previously used in PISA 2012 and PISA 2015. Responses are given on a five-point Likert scale ranging from 1 'strongly disagree' to 5 'strongly agree'. In PISA 2015, the reliability of the scale (the Norwegian questions) was .86. Note that the answering format in PISA is a four-point Likert scale with the answering categories ranging from 'strongly agree', 'agree', 'disagree', and

‘strongly disagree’. We chose to include a ‘neutral’ option to increase reliability – a five-point Likert scale is the standard response format in the Norwegian Pupil Survey. Moreover, note that the question regarding students’ perceptions of loneliness at school is an item already included in the compulsory part of the Norwegian Pupil Survey.

Bullying is measured by means of one item and the question is compulsory in the Norwegian Pupil Survey. The students are asked whether they have been bullied by other students at school during the past few months. The response categories are ‘not at all’, ‘rarely’, ‘2 or 3 times a month’, ‘about once a week’, and ‘several times a week’. In the literature, there is a lack of consensus regarding the frequency of bullying that should occur to be defined as bullied. For instance, Olweus (2013) suggest 2 or 3 times a month, while Roland (1999) propose once or several times a week. In research reports analysing the Norwegian Pupil Survey data, a student is defined as bullied if he or she experience bullying 2 or 3 times a month or more (Wendelborg, 2017). Moreover, the research reports provide information regarding the criteria for excluding not reliable/unserious responses. Respondents who states that they experience bullying from others, from teachers, and cyberbullying several times a week, and in addition states that they bully others on the same questions, are excluded from the analysis. In the Norwegian Pupil survey 2016 this amounted to 0,1 percent (623 students) of the respondents (Wendelborg, 2017).

The final primary outcome is student absence. Each semester (spring/autumn) the participating municipalities will provide de-identified absence data for all pupils in the target grades for each school to the researchers. The data are structured on the individual level with a unique identification number for the individual student and comprise of registrations for each day that semester. Note that the researchers will not know the reasons for students’ absence.

2.4.3 Secondary outcomes

As with the primary outcomes, the secondary outcomes comprise of a psychological dimension, a social dimension, and a cognitive dimension. The psychological dimension comprises of three subdimensions whereas the social dimensions comprise of five subdimensions. The cognitive dimension is measured by the students' results on the Norwegian National Tests. Also, we include student absence in physical education and a measure of implementation as secondary outcomes.

Psychological dimensions

The *psychological dimension* comprises of students perceived *motivation, academic self-concept* and *social well-being* at school. The questions tapping students' *motivation* are compulsory in the Norwegian Pupil Survey and focus on interest and liking for schoolwork – a conceptualisation of motivation corresponding to the theoretical framework of self-determination theory. The theory defines intrinsic motivation as the inherent pleasure and satisfaction derived from engaging in an activity and a main postulate is that social factors promote intrinsic motivation via satisfaction of individuals' basic needs for autonomy, competence, and relatedness (Deci & Ryan, 2000; Ryan & Deci, 2000). The measure comprises of three items and previous analyses have shown a Cronbach's alpha of .77 – .79 (Federici et al., 2016; Wendelborg, Røe, & Caspersen, 2016) . The responses are given on a 5-point scale ranging from 'not in any subjects/not at all' (1) to 'in all subjects/to a large degree' (5). Note that this measure is a composite of questions with different response categories. Therefore, one may question to what degree it functions as a scale or an index. Previous analyses of the Norwegian Pupil Survey (Wendelborg et al., 2016; Wendelborg et al., 2014) indicate that the measure function as a scale indicative of students' motivation.

Self-concept is measured by a four-item scale representing a short version of the subscale of a Norwegian version of the Self-Description Questionnaire SDQ II (Marsh, 1992;

Skaalvik & Rankin, 1992). In general, self-concept is a multidimensional construct referring to self-perceptions in different areas or domains (Bong & Skaalvik, 2003; Marsh, Byrne, & Shavelson, 1988). Academic self-concept is often defined as students' perceptions of doing well or poorly in school in general (general academic self-concept) or domains, for instance, mathematics self-concept. In the present study, we measure general academic self-concept. Responses are given on a five-point Likert scale ranging from 1 'strongly disagree' to 5 'strongly agree'. Previous studies have revealed a Cronbach's alpha of .77 (Skaalvik & Skaalvik, 2013).

The questions tapping into students' *social well-being* is an index focusing on perceptions of well-being at school in general, in class, and between lessons (break/playtime). The responses are given on a 5-point scale ranging from 'I don't thrive at all/not at all' (1) to 'I always thrive/to a large degree' (5). This measure is a composite of questions where one of the items have a different type of response categories. We will conduct confirmatory factor analyses to investigate the behaviour of this item and exclude it if it does not reach statistical significance and other measures of goodness of fit statistics (described earlier). Preliminary analyses of data from the Norwegian Pupil Survey 2016 reveals a Cronbach's alpha of .81.

Social dimensions

The *social dimension* of the secondary outcomes comprises of students' perceptions of bullying, their work- and social environment, perceived emotional and instrumental support from teachers, and a question regarding school meals.

The Norwegian Pupil Survey includes additional items tapping into different aspects of *bullying* at school. The first additional item included in the present study is related to the item concerning bullying defined as a primary outcome. It asks the students whether the school provided help. Note that this question is only given to students who report that he or she experience bullying 2 or 3 times a month or more. The response categories are 'no, no

adults knew anything', 'the school knew, but didn't do anything', 'yes, the school provided measures, but it didn't help', 'yes, the school provided measures, and it helped a bit', and 'yes, the school provided measures and bullying stopped'. Moreover, all students are asked whether they have experienced cyberbullying or been bullied from teachers. Finally, two items ask the students whether they bully others, both at school and cyberbullying. The response categories for the latter items are 'not at all', 'rare', '2 or 3 times a month', 'about once a week', and 'several times a week'.

The students' perceptions of their *work environment* are measured by three compulsory items in the Norwegian Pupil Survey. The questions focus on the students' opportunities to work undisturbed, to what degree the class in general perceive working hard with school work is important, and to what degree the teachers consider mistakes to be part of the learning process. Responses are given on a five-point Likert scale ranging from 1 'strongly disagree' to 5 'strongly agree'. Previous studies have revealed a Cronbach's alpha of 0,66 (Wendelborg et al., 2016).

Research identifies several dimensions of teacher support, such as emotional, informational, appraisal, and instrumental support (House, Umberson, & Landis, 1988; Malecki & Demaray, 2003). The number of dimensions and the labels used for them varies. However, in general, the categories of emotional and instrumental support are typically reported (Semmer et al., 2008). Emotional support is characterised by empathy, friendliness, encouragement, esteem, and caring, whereas instrumental support is characterised by tangible support, for instance, when teachers help students solve a problem or accomplish a difficult task. In the present study, students' perceptions of the teachers as *emotionally supportive* is measured by three items. The scale is a shortened and modified version of a previously tested scale of emotional support (Federici & Skaalvik, 2014b; Skaalvik & Skaalvik, 2013).

Previous studies have revealed a Cronbach's alpha of .80 and .94. The responses are given on a 5-point scale ranging from 'strongly disagree' (1) to 'strongly agree' (5).

Three items measure the students' perceptions of teacher *instrumental support*. The questions are compulsory in the Norwegian Pupil Survey and focus on tangible support and to what degree students ask for help when needed. The responses are given on a 5-point scale ranging from 'strongly disagree' (1) to 'strongly agree' (5). Preliminary analyses of data from the Norwegian Pupil Survey 2016 reveals a Cronbach's alpha of .71.

Finally, the social dimension includes one item concerning school meals. The question is developed for the present study and the students are asked to what degree the meal break is characterized by 'calm and order'. The responses are given on a 5-point scale ranging from 'strongly disagree' (1) to 'strongly agree' (5)

Cognitive dimension

The cognitive dimension comprises of students results one the Norwegian National Tests. The National Tests were introduced in Norway in 2004 as part of a quality assessment system in education. These tests are run every autumn on 5^{th}, 8^{th}, and 9^{th} graders and focus on core academic skills namely numeracy, literacy, and English. The main purpose of the tests is to provide educational authorities at local and national level with information on general student competency after the 4^{th}, 7^{th}, and 8^{th} year of compulsory schooling.

We will use two types of test that are already implemented in schools. The national test in reading, English and mathematics for 5^{th} grade students will be used to measure pre-intervention levels in students' achievement. These national tests are available for the whole Norwegian student population, with a few exemptions. The cohort born in 2006 took the 5^{th} grade test in the fall of 2016. They will take a national test in the same subjects in 8^{th} grade in the fall of 2019 when students who attended the treatment schools have been exposed to 1.5 years of an extra school nurse resource. We will compare development in test results in 8^{th}

grade between treatment and control schools for this cohort. Depending upon additional funding, we will also conduct a study of the 2007 cohort who took the 5th grade test in 2017 and will take the 8th grade test in 2020, to measure the impact of the full two years of intervention, and studying effects on the two cohorts combined.

Student absence

In addition to obtaining data of student absence in general, we wish to investigate the prevalence of absence during physical education classes. Note that there are some uncertainties about whether it is possible to get these data from the municipal authorities.

Implementation

We also include a measure related to the implementation and process evaluation in the Norwegian Pupil Survey. The students are asked two questions regarding to what degree they know the school nurse and to what degree the school nurse is an 'adult that is easy to talk with'. The main aim of these questions is to investigate possible differences in perceptions of the school health service between the treatment and control schools.

Table 3: Primary outcomes

Scale	Items (Norwegian)	Items (English)	Source and comments
Psychological dimensions			
Emotional well-being at school	Tenk på hvordan du har hatt det i klassen den siste uken. Hvor ofte har du?	Recall how you`ve felt last week in class. How often have you felt the following?	Russell (2003)
	Har du vært glad?	Been happy	
	Har du vært trist?	Been sad	
	Har vært stresset?	Been stressed	
	Har du kjedet deg?	Been bored	
	Har du hatt det morsomt?	Had fun	
Social dimensions			
School belonging	Det virker som de andre elevene liker meg	Other students seem to like me	OECD (2013)
	Jeg får lett venner på skolen	I make friends easily at school	
	Jeg føler at jeg hører til på skolen	I feel like I belong at school	
	Hender det at du føler deg ensom på skolen[1]	Do you sometimes feel lonely at school	
	Jeg føler meg annerledes og at jeg ikke passer inn på skolen	I feel different than others and out of place in my school	
	Jeg føler at jeg blir holdt utenfor på skolen	I feel like an outsider (or excluded out of things) at school	
Bullying	Er du blitt mobbet av andre elever på skolen de siste månedene?	Have you been bullied by other students at school during the past few months?	Wendelborg (2017) Wendelborg et al. (2014)
Student absence	-	-	Obtained from the municipal authority

[1]Question asked in the compulsory part of the Norwegian Pupil Survey

Table 4: Secondary outcomes related to psychological dimensions

Scale	Items in Norwegian	Items in English	Source and comments
Psychological dimensions			
Motivation	Er du interessert i å lære på skolen?	I am interested in learning at school	Wendelborg et al. (2014) Federici et al. (2016)
	Hvor godt liker du skolearbeidet?	I like schoolwork	
	Jeg gleder meg til å gå på skolen	I look forward to school	
Academic self-concept	Jeg lærer lett i alle fag på skolen	Doing work in all school subjects is easy	Skaalvik and Skaalvik (2013)
	Skolearbeidet er lett for meg	School work is easy for me	
	Jeg trenger mye hjelp med skolearbeidet	I need a lot of help with my schoolwork	
	Skolearbeidet er ofte vanskelig for meg	School work is often hard for me	
Social well-being at school	Trives du på skolen?	Do you like being at school?	Wendelborg et al. (2014)
	Har du noen medelever å være sammen med i friminuttene?	Do you have other students to be with in the breaks?	
	Trives du sammen med elevene i gruppa/klassen din?	Do you like being with your fellow students?	
	Trives du i friminuttene/fritimene?	Do you enjoy the breaks?	

Table 5: Secondary outcomes related to social dimensions

Scale	Items in Norwegian	Items in English	Source and comments
Social dimensions			
Bullying	Gjorde skolen noe for å hjelpe deg?	Did the school provide any help?	Wendelborg (2017) Wendelborg et al. (2014)
	Er du blitt mobbet digitalt (mobil, iPad, PC) de siste månedene?	Have you experienced cyberbullying the last months?	
	Har du selv vært med på å mobbe en eller flere elever på skolen de siste månedene?	Have you bullied other students during the last months?	
	Har du mobbet andre digitalt (mobil, iPad, PC) de siste månedene?	Have you bullied others using you cell, iPad or computer the last months?	
	Er du blitt mobbet av voksne på skolen de siste månedene?	Have any adults bullied you during the last months?	
Work environment	Det er god arbeidsro i timene	In class, we can work undisturbed	Wendelborg et al. (2016)
	I klassen min synes vi det er viktig å jobbe godt med skolearbeidet	In my class, we think it is important to work with school tasks	
	Mine lærere synes det er greit at vi elever gjør feil fordi vi kan lære av det	My teachers think it is ok to do mistakes, because we learn from them	
Instrumental support	Når jeg har problemer med å forstå arbeidsoppgaver på skolen, får jeg god hjelp av lærerne	When I don't understand school work, the teachers help me	Wendelborg et al. (2016)
	Jeg ber læreren om hjelp hvis det er noe jeg ikke får til	I ask my teacher for help if there is something I don't understand	
	Lærerne hjelper meg slik at jeg forstår det jeg skal lære	My teacher helps me to understand what I have to learn	
Emotional support	Mine lærere behandler meg på en vennlig måte	My teachers treat me nicely	Federici and Skaalvik (2014b)
	Jeg føler at lærerne vil mitt beste	I feel that my teachers want what's best for me	
	Lærerne oppmuntrer meg når det er noe jeg ikke får til	My teachers encourage me if there is something I don't master	
Meals	I klassen min er det ro og orden når vi spiser skolematen vår	In my class, calm and order is typical when we eat our meals	Developed for the present study

Table 6: Student absence and learning outcomes

Scale	Items in Norwegian	Items in English	Source and comments
Student absence			
PE participation		Students' participation in PE class.	Obtained from the municipal authority
Cognitive dimension			
Results on national tests		Student scores on national tests in mathematics, reading, and English	Register data obtained from Statistics Norway

Table 7: Implementation

Scale	Items in Norwegian	Items in English	Source and comments
Implementation			
School nurse	Jeg vet hvem helsesøster er på skolen Helsesøster på skolen er en voksen det er lett å snakke med	I know the school nurse The school nurse is a person it is easy to talk with	Developed for the present study

2.5 Sample and effect size

The sample used in this study consists of an estimated 11,000 students in grade 5-7 at each point in time, distributed across 14 municipalities and 123 schools. The sample size was determined based on an initial power analysis. With access to more data, we here present an updated analysis of the detectable effect size in this study.

For most of the measures that we will use in the study, previous measures are not available. Furthermore, data on learning environment from the Pupil's survey is only available for 7th grade. One of the measures we will use as a primary outcome which is available is the number of children who report being bullied 2-3 times per month or more frequently, a limit recommended by Olweus (1991). The intra-class correlation between schools was 0.02 on this variable, using data from 2016.

For the power analysis, we will use another measure which consists of two questions about well-being in the Norwegian Pupil Survey, conducted among 7th graders in 2016. This is not one of our primary outcomes, as the primary outcomes other than bullying are not available in previous surveys that we have access to at the time of randomisation. However, we believe the answers will be highly correlated with our primary outcome variables.

The responses to the questions on well-being are given values 1-5 where 5 is the most positive response. The statistic is then standardised and thereafter averaged across the two items. This average is then standardised again to create a combined indicator at the school level. The intraclass correlation of this variable is 0.05.

The three questions are shown in table 8. We have used this two-item measure of well-being as the basis for the power analysis, since we have data on this indicator from 2015 and 2016. Unfortunately, we only had 23 schools and 913 7th graders in participating schools in our sample. Therefore, we selected an additional 190 schools with 8035 students from other municipalities in our simulation sample.

Table 8: Questions used in randomisation

Scale	Items in Norwegian	Items in English	Statistics	Combined statistics
Psychological dimensions				
Bullying	Er du blitt mobbet av andre elever på skolen de siste månedene? Svaralternativ: Flere ganger i uken – omtrent en gang i uken - to eller tre ganger i måneden – en sjelden gang – ikke i det hele tatt	Have you been bullied by other students in school during the last months? Responses: Several times a week – about once a week – twice or three times per month – seldom – not at all	Mean: 0.055 SD: 0.23 Respondents 2016: 56,794 School ICC: 0.02	
Well-being	Trives du på skolen? Svaralternativ: Trives svært godt – trives godt – trives litt – trives ikke noe særlig – trives ikke i det hele tatt	Do you like it at school? Responses: Like it very well – like it well – like it a bit – does not like it much – does not like it at all.	Mean: 4.37 SD: 0.71 Respondents 2016: 56,664 School ICC: 0.07	Mean before standardisation: 0.002 SD before standardisation: 1.70 Respondents 2016: 56,380 Standardised measure school ICC: 0.05
	Har du noen medelever å være sammen med i friminuttene? Svaralternativ: Alltid – ofte - noen ganger – sjelden – aldri	Do you have fellow students to be with during breaks? Responses: Always – often – sometimes – rarely – never	Mean: 4.72 SD: 0.57 Respondents 2016: 56,458 School ICC: 0.03	

Half the schools were assigned treatment status, and for the students in the treatment group, an additional term was added to the standardised combined response statistic. The term was a normally distributed random variable with mean 0.1 standard deviations, and 95% was added as an individual effect and 5% as a shared, school effect. This was simulated 400 times, and effect sizes were then calculated.

The effect sizes were calculated in two models, one which included the school mean score in 2015 as a control. The 2015 school mean turned out to be highly correlated with the 2016 individual scores, with a correlation rate of 0.21. Furthermore, the predictive value of the previous score was very high, with a one standard deviation increase in 2015 predicting a 0.64 standard deviations increase in 2016.

Table 9 shows the results of the simulations, after correcting the significance levels for multiple hypothesis testing using the false discovery rate method (see chapter 4 for details).

We see that without the baseline control, the probability is 70% for finding at least one significant result when testing four hypotheses. With the baseline control, the probability rounds up to 100 %. In the 400 simulations, 98,5% of the p-values were lower than 0.0125 in this model.

Table 9: Simulated probability of detecting effect

	0.1, without controls	0.1, with baseline control
1 significant	70 %	100 %
2 significant	68 %	100 %
3 significant	67 %	100 %
4 significant	67 %	100 %

Though these simulations are very encouraging, it remains to be seen whether these results will reproduce in the actual study. It is clear that a discovery rate above the usual threshold of 80% as found through the simulation depends heavily on the strong intertemporal correlation and the weak intra-cluster correlation in this estimate. The primary outcomes may have a lower intertemporal correlation.

3 Randomisation

Causal inference based on this trial relies on the comparison of schools that are randomly selected to receive an extra school nurse resource with schools whose nurse-to-student ratio is unaffected by the trial. For this trial, we will use a stratified, cluster-randomised design. First, the selection of schools is stratified by municipality. Within each municipality, four schools are selected to receive the treatment and all other schools that fulfil the selection criteria are followed as a control group. The reason for stratifying at the municipal level is both practical and purposeful. As the responsibility for the school health service lies with the municipality, an equal allocation of resources to each municipality was necessary for recruitment. Since factors that are likely to influence learning environment (such as socio-economic background,

prior nurse coverage, and school quality) varies between municipalities, stratification at this level will improve balance.

We then stratify a second time within each municipality, based on the measure of well-being and bullying which was presented in section 2.5. This is done to improve the balance between the control and trial groups along relevant dimensions. We here follow Athey and Imbens (2017) who argue that stratification until there are two treated units within each stratum is the method that leads to the smallest standard errors, tangent to other methods such as re-randomisation.

Each municipality is thus divided into two strata, to balance both the combined well-being indicator and the bullying indicator. To do this, we follow a similar strategy as that used by Greevy, Lu, Silber, and Rosenbaum (2004) and King et al. (2007) for optimal multivariate matching before randomisation. Within each municipality, we rank each school according to student well-being and bullying. With these two rankings, we calculate the Mahalanobis distance to the top ranking (1,1). Each municipality has between 7 and 13 eligible schools, and the lowest performing half based on the Mahalanobis score become one stratum and the highest performing half another stratum. In the cases where there is an uneven number of schools in the municipality, a random school will be randomly placed in the lower or the upper stratum. The process from recruitment through school selection is described in the following flow chart, figure 2.

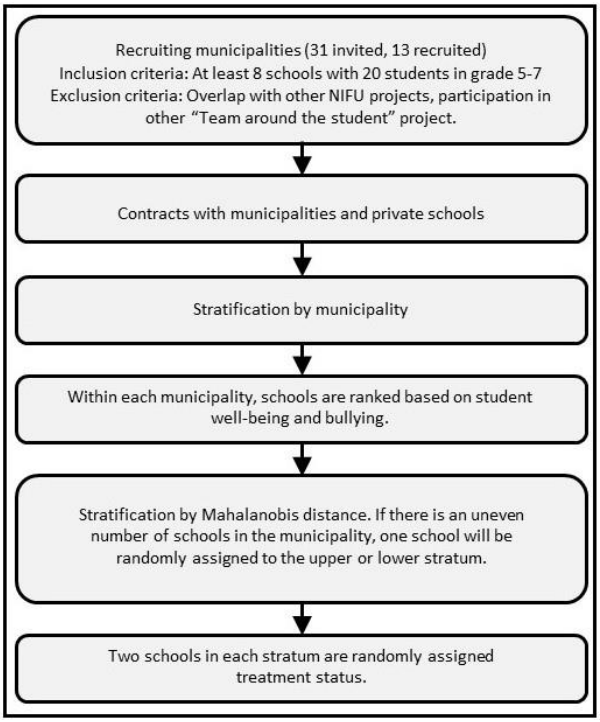

Figure 2: Flow chart of recruitment and randomization

A number of balancing tests will be carried out to assess whether the control and treatment groups are comparable. Variables that will be compare include the nurse-to-student ratio prior to the intervention, school nurse years of practice prior to intervention, and the primary outcomes.

4 Statistical model

The trial will test the hypotheses that additional school nurse resources contribute to the four primary outcomes defined in this protocol. These four outcomes will be measured at five points in time, before the trial begins at t_0 and each semester during the trial (t_1-t_4). The main analysis will use all time points t_1-t_4 controlling for the levels in t_0, but a separate analysis will also be conducted at each time point t_1-t_4. Specifically, we are interested in whether the nurse-to-student ratio affects the outcomes (Guttu, Engelke, & Swanson, 2004). Using the nurse-to-student ratio is a convenient way of handling three factors that may confound a reduced form estimate. First, the school size in our study varies considerably from 20 students in the 5th – 7th grade target group, to 238 students. We would expect that the same absolute increase in school nurse coverage would have a larger impact in a small school than in a large school. Secondly, school nurse coverage is decided at the municipal level[3] and thus varies considerably between municipalities. Furthermore, the nurse coverage is likely to increase during the period under study. Thirdly, there is a potential issue of partial compliance (Glennerster & Takavarasha, 2013) and we want to be able to conduct the analysis even if compliance is sub-optimal. Our main specification thus uses the instrumental variables method to estimate a local average treatment effect (Angrist & Pischke, 2008), given that we obtain a first-stage F-statistic of 10 or above. Results will be interpreted as effects of an

[3] There is a national norm of minimum of one nurse per 300 students in primary schools, but the norm is not binding. Only 2.5% of primary schools in Norway adhere to the norm (Waldum-Grevbo & Haugland, 2015).

increase in the nurse-to-student ratio from the mean which corresponds to the increased resource. Specifically, we estimate the following set of equations:

$$Y_{ist} = \alpha_t + \beta_1 \log(\widehat{Ratio}_{st}) + \beta_{2t} Stratum_s + \beta_{3t} Y(t_0)_s + \beta_{4t} X_{it} + \epsilon_{ist} \quad (1)$$

$$\log(Ratio_{st}) = \gamma_t + \delta_1 Treatment_s + v_{st} \quad (2)$$

Where Y_{ist} is the outcome of child *i* at school *s* at time *t* (running from t_1-t_4), α_t is a constant by time period, $Ratio_{st}$ is the empirically observed nurse-to-student ratio in 5th – 7th grade, $Stratum_s$ are dummy variables for each stratum, $Y(t_0)_s$ is the average initial level of the outcome variable in each school, and X_{it} are dummies for sex and grade. In equation (2), the nurse-to-student ratio is instrumented by the treatment status of the school, $Treatment_s$, and the equation also includes a constant per time period. Standard errors are clustered at the school level. We will also conduct a reduced form analysis, using data aggregated to the school level and weighting by the number of respondents.

The outcome variables are constructed in the following way. For the questions on 'emotional well-being', the two positive emotions (been happy and had fun) will be given values from 1 (never) to 5 (always). The three negative emotions (been sad, stressed, and bored) will be given values from 5 (never) to 1 (always). An average will be calculated for each child, and we will conduct a log transformation. A similar outcome variable will be constructed for 'school belonging' where responses to the three positively loaded questions will be given values from 1 (completely disagree) to 5 (completely agree) whereas the three negatively loaded questions will be given values in opposite order. An average will be calculated per child and the variable will be log transformed. Bullying will be studied using a linear probability model. All these three outcomes will be studied using two-stage least squares, whereas a Poisson regression using generalised method of moments will be estimated for days of absence per semester as outcome (Wooldridge, 2010).

With four outcomes, we will correct the critical levels for rejecting null hypotheses for multiple hypotheses testing. However, the Bonferroni correction method is too restrictive if the hypotheses are correlated, which is an assumption in our study. We will therefore use the false discovery rate method developed by Benjamini and Hochberg (1995) (see also Fink, McConnell, and Vollmer (2014)). We will order the four outcomes from the lowest to the highest p-values and assign each outcome rank i. Let k be the lowest i for which

$$p(i) \leq 0.05 * i/\mathrm{m} \qquad (3)$$

Where $p(i)$ is the i^{th} ranked p-value, and m is the number of hypotheses to be tested. All null hypotheses ranked k or below will be rejected. For the primary outcomes, m is four. For each group of secondary outcomes, a similar correction will be conducted.

4.1 Sub-group analyses

A few sub-group analyses of particular interest will be undertaken. These will be modelled as interaction effects where both the instrument and the explanatory variable are interacted. We want to test differences by gender. There are few gender differences in reported bullying (Wendelborg, 2017) and well-being (Wendelborg et al., 2016) in 5^{th} – 7^{th} grade. Havik et al. (2015) found that girls report slightly higher absence than boys in 6^{th} – 10^{th} grade and that boys report more truancy-related reasons for their absence. Rather than being motivated by differences in outcome levels between boys and girls, the motive for a sub-group analyses by gender is that school nurses – of whom the vast majority are women – may be more able to influence the psychosocial environment for girls than for boys. We will also test whether effects vary by grade.

A second sub-group analysis will be conducted by whether the share of nurse time usage allocated to groups or universal efforts is above or below the level received by the median child. Another interaction term will capture whether the school-to-student ratio without the extra resource is above or below the level for the median child.

Further sub-group analyses relate to the level of the outcome variable at baseline, where we will test whether effects are larger at schools where the levels were above or below that of the median child. For absence, we will test whether effects are larger for individual children with absence above or below the median child at baseline.

5 Issues of internal validity

This section will examine a number of threats to internal validity, and provide solutions to how risks can be assessed and handled. First, risks of partial compliance and non-compliance by municipalities and school nurses will be discussed. A second issue is attrition by municipalities, schools and individuals. Sub-section three discusses spill-overs and externalities, and sub-section four Hawthorne and John Henry effects.

5.1 Partial compliance

Partial compliance may arise as an issue at several levels in the study. First, there may be partial compliance in the allocation of school nurse resources by the municipality. The resource is deployed during a period of rapid expansion of the school health service in Norway, which led to an increase in school health positions by 25% in the 2010-2015 period (own calculations based on data from Statistics Norway). Continued expansion thereafter came initially as budget support to municipalities, and in 2016 also through targeted funding from the central government (The Norwegian Directorate of Health, 2016). In 2017 and 2018, a reward for having allocated budget support to the school health service and community health stations has provided further expansions in compliant municipalities (The Norwegian Directorate of Health, 2017). There is a national norm of minimum of one nurse per 300 students in primary schools, but the norm is not binding and only 2.5% of primary schools in Norway adhered to the norm in 2015 (Waldum-Grevbo & Haugland, 2015). Municipalities thus have great discrepancy in choosing the level and distribution of school nurse coverage in

their primary schools, and are likely to increase their nurse coverage during the project period. This provides a challenge for possible partial compliance of the programme through compensatory allocation of nurse resources. Two measures have been taken to avoid that municipalities take compensatory measures. First, municipalities are obligated not to undertake compensatory measures through a signed contract. Secondly, the municipalities are providing information on the school nurse coverage on 1 September 2017, 1 November 2017, 1 January 2018, and throughout the project period. If school nurse coverage changes to disproportionately benefit schools in the control group, the municipality will be asked to document the reasons for such allocation.

Another issue of partial compliance is if the school nurse appointed for the project differs significantly from other school nurses in competence and skills. An issue related to the rapid expansion of the school nurse resource is that municipalities struggle to acquire school nurses, who in the Norwegian educational system are nurses with a specialisation in school health. All municipalities that do not have excess capacity within their ranks are obligated to advertise the school nurse position and to hire a school nurse if there is a qualified applicant. Municipalities may also use the funding to hire a regular nurse or a person with a different profession to alleviate other tasks from the school nurses. If none of these options are available, the municipalities may temporarily appoint a nurse in a school nurse position, under supervision of an educated school nurse. We require that municipalities in these cases hire for one year at the time, and make another attempt at hiring a school nurse for 2019. Another issue which we want to avoid is that the school health service in the treatment schools are split between more school nurses than the control schools, and that there are differences in educational backgrounds or years of experience. This is regulated through the contract with the municipalities, who are expected to make rearrangements in the assignment of individual nurses to schools to ensure continuity.

Given the correct assignment of school nurses by the municipality, a remaining issue of partial compliance rests with the fidelity towards the implementation of the treatment by the school nurse. To that end, all school nurses working in primary schools in the municipality will fill in a time registration survey every fourth week in a rotating system. This shall monitor both potential re-allocation of resources between schools, and re-allocation between 5^{th}-7^{th} grade and other grades within each school. The municipality will be notified if the extra allocation falls short of the minimum 3,25 hours per week per school in a given month.

According to the contract, partial compliance may lead to the retention of funds. Partial compliance may lead to a too small scale of the treatment to identify significant effects. However, by using treatment status as an instrumental variable for the nurse-to-student ratio in the analyses, lack of compliance with the scale of the intervention should not affect the effect size, only standard errors.

5.2 Attrition

Issues of attrition may arise if municipalities, schools, or individuals opt out of the programme. Each municipality has appointed a contact person whom we are in regular contact with to ensure full participation, and meetings with senior officials have been conducted to ensure that the project is backed at a high administrative level. Nevertheless, municipalities may drop out of the project which would reduce the sample size and potentially threaten the statistical power needed for the experiment. Since randomisation has been conducted within each municipality, it would, however, not affect the estimated results unless correlated with impact of the school nurse resource.

Schools who drop out of the project provides a concern in the case of private schools, who may not be instructed to participate by the municipality. We therefore have separate contracts with the private schools that are binding, and which were made before

randomisation. In the event of a school dropping out of the project, the entire stratum has to be excluded from the study.

A particular cause for concern is if individuals opt out of the programme, especially since individual non-response to the questionnaire might be correlated with the response. The most obvious case is that of students who are absent from class during the day of the survey. If the treatment has reduced absence, there might also be higher absence during the day of the survey in the control schools than in the treatment schools, and the participating students may thus report a better learning environment in the control schools. We will therefore conduct an analysis of whether attrition is higher in the control schools. In such cases, we will impute missing values with the least favourable non-omitted response by gender and grade in the stratum as a robustness check. Another sensitivity analysis will exclude strata with selective attrition.

A similar issue arises if students who experience a poor psychosocial environment change to a school with a better learning environment. We will analyse whether there are differences in how the number of students in control and treatment schools change over time. Depending on evidence for such differential change, we will impute values and run the analysis when such strata are excluded, in the same manner as with absent students. This rests upon the assumption that students who change school are not replaced by a new student, which is unlikely in the Norwegian school system where primary schools rarely have students on waiting lists.

5.3 Spill-overs and externalities

The project is implemented shortly after the introduction of new guidelines for the school health service in September 2017 that recommends tasks for the school nurses that in some municipalities will be drastically different from the way in which school nurses have operated. This study seeks to test whether an extra school nurse resource which is used in

accordance with these new guidelines has an impact on the learning environment. To that end, a number of measures are undertaken to make sure the school nurse in the treatment schools adhere to the new practices. Treatment schools and treatment school nurses are given a guide on how to work with the learning environment, they are invited to workshops, and headmasters are responsible for structuring the collaboration with established meeting points. Both headmasters and school nurses in the control schools may learn from their colleagues and are equally encouraged from the health authorities to follow the recommendations in the new guidelines. Our experiment will test whether an extra resource used for these purposes affects the learning environment, and not effects of structured and systemic collaboration in itself. Spill-overs and externalities of the resource usage are expected to be small, and those related to the type and quality of service delivery will have to be considered when interpreting results. A survey to the school nurses will track whether the implementation of the guidelines is very distinct in the treatment schools, to ease such interpretation.

5.4 Hawthorne and John Henry Effects

Hawthorne effects refer to that the treatment group may change their behaviour because they know that they are part of a research programme, and John Henry effects refer to similar behaviour changes in the control group. Being the only major study of the effect of school nurses on the learning environment, members of the school nurse profession have a large and long-term stake in the project making positive findings. However, the extent to which school nurses can and are willing to directly influence results through working extra hard in treatment schools and slacking off in control schools is probably very limited. A strong professional ethos postulates that school nurses will do their best to promote the psychosocial environment in all schools. Likewise, school administrators and teachers are highly aware of a new law which gives all adults an individual responsibility for the school environment, which is likely to be a firm focus in all schools. Questions about how the intervention is perceived

will be raised in qualitative interviews, to discover potential Hawthorne and John Henry effects.

5.5 Generalisability and scalability

The school health service in Norway is rapidly expanding, yet nurse to student ratios are still well below the coverage recommended by the government. We claim that the size and content of the extra service provided in this experiment is relevant and scalable for the Norwegian government, should they wish to expand current coverage.

The average schools size in our sample is 90 students in the target grades. If schools fulfil the ideal coverage, that should imply a 30% nurse position devoted to this group. The additional resource increases the service with a 12.5% position, which implies a 40% increase. Given the rate of upscaling over the years 2010-2015, this corresponds to 7 years of expansion of the service at its current pace. Thus, the intervention tests a politically feasible effect size which is relevant for national authorities.

We have also made attempts to make the intervention replicable and relevant for possible upscaling in the Norwegian context. The requirements of systemic and structured work are closely aligned to new policy guidelines for the school health service as well as new requirements on the school's responsibility to ensure an adequate school environment. By testing an intervention where the collaboration is in line with these guidelines and supports improvements in the psychosocial environment but where the local actors are otherwise free to shape the content of the intervention, the experiment tests conditions that are similar to those that would be in place if scaled up.

One challenge to scalability is whether general equilibrium effects would make recruitment of school nurses difficult if the service was to expand. Availability of school nurses is already a challenge in the project. In line with Norwegian law, a regular nurse may be hired temporarily in a school nurse position if supervised by an educated school nurse. In

this project, municipalities are allowed to hire a regular nurse if recruitment of a school nurse is not possible, but is only allowed to hire the nurse for one year at the time and should make an attempt to re-allocate resources so that an educated school nurse will be assigned to the project duties. This allowance makes the findings more generalisable, as a nation-wide expansion is likely to have similar problems in recruiting school nurses.

As the municipalities were not recruited at random, due care has to be taken when interpreting the results from this RCT to the national context. All municipalities are medium-sized, yet are scattered across the whole country. To address this, an analysis of differences between the participating municipalities and other municipalities will be undertaken, and the study of heterogeneous effects will be able to tell us whether there are characteristics that makes a successful finding more likely.

6 Other information

6.1 Harms

The questionnaires, interview guides, the procedure, and ethical considerations were approved by the Norwegian Centre for Research Data (NSD).

6.2 Registration

This protocol was registered on the XX database, on the 01.01.01 with the following registration number XX.

6.3 Protocol

The full protocol can be access at www.lagrundteleven.no/protocol and at www.xxx.xx

6.4 Funding

The project runs from 2017 to 2020 and is conducted by the Nordic Institute for Studies in Innovation, Research, and Education (NIFU), the Norwegian Institute of Public Health (NIPH), and the Centre for Learning Environment at the University of Stavanger.

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References

Angrist, J. D., & Pischke, J. S. (2008). *Mostly Harmless Econometrics: An Empiricist's Companion*: Princeton University Press.

Athey, S., & Imbens, G. W. (2017). The Econometrics of Randomized Experimentsa. *Handbook of Economic Field Experiments, 1*, 73-140. doi:http://dx.doi.org/10.1016/bs.hefe.2016.10.003

Baisch, M. J., Lundeen, S. P., & Murphy, M. K. (2011). Evidence-Based Research on the Value of School Nurses in an Urban School System. *Journal of School Health, 81*(2), 74-80. doi:10.1111/j.1746-1561.2010.00563.x

Baumeister, R. F., & Leary, M. R. (1995). The Need to Belong - Desire for Interpersonal Attachments as a Fundamental Human-Motivation. *Psychological Bulletin, 117*(3), 497-529.

Benjamini, Y., & Hochberg, Y. (1995). Controlling the False Discovery Rate: A Practical and Powerful Approach to Multiple Testing. *Journal of the Royal Statistical Society. Series B (Methodological), 57*(1), 289-300.

Bliksvær, T., Hannås, B. M., Hustad, B. C., & Strømsvik, C. L. (2015). *Prosjekt «Tidlig innsats i oppvekst» i Asker kommune. En følgeevaluering.* Retrieved from Bodø:

Bong, M., & Skaalvik, E. M. (2003). Academic Self-Concept and Self-Efficacy: How Different Are They Really? *Educational Psychology Review, 15*(1), 1-40. doi:10.1023/A:1021302408382

Borg, E., Christensen, K., Fossestøl, K., & Pålshaugen, Ø. (2015). *Hva lærerne ikke kan! Et kunnskapsgrunnlag for satsning på bruk av flerfaglig kompetanse i skolen*. Retrieved from Oslo:

Borg, E., Drange, I., Fossestøl, K., & Jarning, H. (2014). *Et lag rundt læreren. En kunnskapsoversikt*. Retrieved from

Borgonovi, F., & Pál, J. (2016). *A Framework for the Analysis of Student Well-Being in the PISA 2015 Study*: OECD Publishing.

Bru, E., & Hancock, C. H. H. (2017). Å bli mobbet og skolerelaterte konsekvenser. In K. Breivik, E. Bru, C. H. H. Hancock, E. C. Idsøe, T. Idsøe, & M. E. Solberg (Eds.), *Å bli utsatt for mobbing. En kunnskapsoppsummering om konsekvenser og tiltak*. Stavanger: Læringsmiljøsenteret.

Byrne, B. M. (2010). *Structural equation modeling with AMOS: basic concepts, applications, and programming*. New York: Routledge.

Cappella, E., Jackson, D. R., Bilal, C., Hamre, B. K., & Soulé, C. (2011). Bridging Mental Health and Education in Urban Elementary Schools: Participatory Research to Inform Intervention Development. *School Psychology Review, 40*(4).

Cohen, J., McCabe, E. M., Michelli, N. M., & Pickeral, T. (2009). School Climate: Research, Policy, Practice, and Teacher Education. *Teachers College Record, 111*(1), 180-213.

Cornelius-White, J. (2007). Learner-centered teacher-student relationships are effective: A meta-analysis. *Review of Educational Research, 77*(1), 113-143. doi:Doi 10.3102/003465430298563

Credé, M., Roch, S. G., & Kieszczynka, U. M. (2010). Class Attendance in College. A meta-analytic review of the relationship of class attendance with grades and student characteristics. *Review of Educational Research, 80*(2), 272-295. doi:10.3102/0034654310362998

Danielsen, A. G., Samdal, O., Hetland, J., & Wold, B. (2009). School-Related Social Support and Students' Perceived Life Satisfaction. *Journal of Educational Research, 102*(4), 303-320.

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry, 11*(4), 227-268.

Federici, R. A., Caspersen, J., & Wendelborg, C. (2016). Students' perceptions of teacher support, numeracy, and assessment for learning: Relations with motivational responses and mastery experiences. *International Education Studies, 9*(10), 1-15. doi:http://dx.doi.orghttp://dx.doi.org/10.5539/ies.v9n10p1

Federici, R. A., & Skaalvik, E. M. (2014a). Students' perception of instrumental support and effort in mathematics: The mediating role of subjective task values. *Social Psychology of Education, 17*(3), 527-540. doi:10.1007/s11218-014-9264-8

Federici, R. A., & Skaalvik, E. M. (2014b). Students' Perceptions of Emotional and Instrumental Teacher Support: Relations with Motivational and Emotional Responses. *International Education Studies, 7*(1), 21-36. doi:http://dx.doi.org10.5539/ies.v7n1p21

Federici, R. A., & Wendelborg, C. (2013). *Analyse av data fra Utdanningsdirektoratets brukerundersøkelser i skolen. En helhetlige beskrivelse av læringsmiljøet*. Retrieved from Trondheim:

Fink, G., McConnell, M., & Vollmer, S. (2014). Testing for heterogeneous treatment effects in experimental data: false discovery risks and correction procedures. *Journal of Development Effectiveness, 6*(1), 44-57. doi:10.1080/19439342.2013.875054

Glennerster, R., & Takavarasha, K. (2013). *Running Randomized Evaluations: A Practical Guide*: Princeton University Press.

Greevy, R., Lu, B., Silber, J. H., & Rosenbaum, P. (2004). Optimal multivariate matching before randomization. *Biostatistics, 5*(2), 263-275.

Guttu, M., Engelke, M. K., & Swanson, M. (2004). Does the School Nurse-to-Student Ratio Make a Difference? *Journal of School Health, 74*(1), 6-9. doi:10.1111/j.1746-1561.2004.tb06593.x

Havik, T., Bru, E., & Ertesvåg, S. K. (2015). Assessing Reasons for School Non-attendance. *Scandinavian Journal of Educational Research, 59*(3), 316-336. doi:10.1080/00313831.2014.904424

Health, T. N. D. o. (2017). *Nasjonal faglig retningslinje for det helsefremmende og forebyggende arbeidet i helsestasjon, skolehelsetjeneste og helsestasjon for ungdom*. Oslo.

House, J. S., Umberson, D., & Landis, K. R. (1988). Structures and Processes of Social Support. *Annual Review of Sociology, 14*, 293-318. doi:10.2307/2083320

Hoyle, R. H. (2012). *Handbook of structural equation modeling*. New York: Guilford press.

Hu, L.-t., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*(1), 1-55.

Humphrey, N., Lendrum, A., Ashworth, E., Frearson, K., Buck, R., & Kerr, K. (2015). *Implementation and process evaluation (IPE) for interventions in education settings: An introductory handbook*. Retrieved from University of Manchester:

Hustad, B. C., Strøm, T., & Strømsvik, C. L. (2013). *Kompetanse i PP-tjenesten – til de nye forventningene? Kartlegging av kompetansen i PP-tjenestene*. Retrieved from Bodø:

King, G., Gakidou, E., Ravishankar, N., Moore, R. T., Lakin, J., Vargas, M., . . . Llamas, H. H. (2007). A "politically robust" experimental design for public policy evaluation, with application to the Mexican universal health insurance program. *Journal of Policy Analysis and Management, 26*(3), 479-506.

Kline, R. B. (2011). *Principles and practice of structural equation modeling*. New York: Guilford Press.

Malecki, C. K., & Demaray, M. K. (2003). What Type of Support Do They Need? Investigating Student Adjustment as Related to Emotional, Informational, Appraisal,

and Instrumental Support. *School Psychology Quarterly, 18*(3), 231-252. doi:10.1521/scpq.18.3.231.22576

Marsh, H. W. (1992). Self Description Questionnaire (SDQ) II: A theoretical and empirical basis for the measurement of multiple dimensions of adolescent self-concept: An interim test manual and a research monograph. *New South Wales, Australia: University of Western Sydney, Faculty of Education*.

Marsh, H. W., Byrne, B. M., & Shavelson, R. J. (1988). A multifaceted academic self-concept: Its hierarchical structure and its relation to academic achievement. *Journal of educational psychology, 80*(3), 366.

Maughan, E. D. (2003). The Impact of School Nursing on School Performance: A Research Synthesis. *The Journal of School Nursing, 19*(3), 163-171. doi:doi:10.1177/10598405030190030701

Maughan, E. D. (2016). Building Strong Children: Why We Need Nurses in Schools. *American Educator, 40*(1), 19-22.

Mega, C., Ronconi, L., & De Beni, R. (2014). What makes a good student? How emotions, self-regulated learning, and motivation contribute to academic achievement. *Journal of educational psychology, 106*(1), 121-131. doi:10.1037/a0033546

OECD. (2013). *PISA 2012 Results: Ready to Learn: Students' Engagement, Drive and Self-Beliefs (Volume III)*. Retrieved from /content/book/9789264201170-en http://dx.doi.org/10.1787/9789264201170-en

OECD. (2017). *PISA 2015 Results (Volume III) Students' Well-Being*. Paris: OECD Publishing.

Olweus, D. (1991). Bully/victim problems among schoolchildren: Basic facts and effects of a school based intervention program. In D. J. Pepler & K. H. Rubin (Eds.), *The development and treatment of childhood aggression* (pp. 411-448). Hillsdale: Lawrence Erlbaum Associates.

Olweus, D. (2013). School Bullying: Development and Some Important Challenges. *Annual Review of Clinical Psychology, 9*(1), 751-780. doi:10.1146/annurev-clinpsy-050212-185516

Rees, G., & Main, G. (2015). *Childrens views on their lives and well-being in 15 countries: An initital report on the Childrens's Worlds survey 2013-2014*. Retrieved from York, UK:

Roland, E. (1999). *School influences on bullying*. Stavanger: Rebell forlag.

Roorda, D. L., Koomen, H. M. Y., Spilt, J. L., & Oort, F. J. (2011). The Influence of Affective Teacher–Student Relationships on Students' School Engagement and Achievement:A Meta-Analytic Approach. *Review of Educational Research, 81*(4), 493-529. doi:10.3102/0034654311421793

Russell, J. A. (2003). Core affect and the psychological construction of emotion. *Psychological Review, 110*(1), 145-172.

Ryan, R. M., & Deci, E. L. (2000). Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. *Contemporary Educational Psychology, 25*(1), 54-67.

Semmer, N. K., Elfering, A., Jacobshagen, N., Perrot, T., Beehr, T. A., & Boos, N. (2008). The emotional meaning of instrumental social support. *International Journal of Stress Management, 15*(3), 235-251. doi:10.1037/1072-5245.15.3.235

Skaalvik, E. M., & Rankin, R. J. (1992). Math and Verbal Achievement and Self-Concepts. *The Journal of Early Adolescence, 12*(3), 267-279. doi:doi:10.1177/0272431692012003003

Skaalvik, E. M., & Skaalvik, S. (2013). School goal structure: associations with students perception of teachers as emotionally supportive, academic self-concept, instrinsic

motivation, and help seeking behavior. *International Journal of Educational Research, 24*(4), 369-385.
Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics*. Boston: Pearson/Allyn and Bacon.
Tharaldsen, K. B., Slåtten, H., Hancock, C. H. H., Bru, E., & Breivik, K. (2017). *Å ivareta barn og unge som har blitt utsatt for mobbing. Erfaringsbasert kunnskap om utforming og organisering av tiltak*. Stavanger: Læringsmiljøsenteret.
The Norwegian Directorate of Health. (2016). Statsbudsjettet 2017: Sterk satsing på helsestasjon- og skolehelsetjeneste.
The Norwegian Directorate of Health. (2017). Tilskudd til helsestasjons- og skolehelsetjenesten.
Waldum-Grevbo, K. S., & Haugland, T. (2015). Hvor er helsesøster? En kartlegging av helsesøsterbemanningen i skolehelsetjenesten. *Sykepleien Forskning, 10*(4), 352-360. doi:10.4220/Sykepleienf.2015.55977
Wang, M.-T., & Holcombe, R. (2010). Adolescents' Perceptions of School Environment, Engagement, and Academic Achievement in Middle School. *American Educational Research Journal, 47*(3), 633-662. doi:10.3102/0002831209361209
Weismuller, P. C., Grasska, M. A., Alexander, M., White, C. G., & Kramer, P. (2007). Elementary School Nurse Interventions: Attendance and Health Outcomes. *The Journal of School Nursing, 23*(2), 111-118. doi:10.1177/10598405070230020901
Wendelborg, C. (2017). *Mobbing og arbeidsro i skolen : Analyse av Elevundersøkelsen skoleåret 2016/2017*. Retrieved from https://samforsk.no/Sider/Publikasjoner/Mobbing-og-arbeidsro-i-skolen.aspx
http://hdl.handle.net/11250/2432896
Wendelborg, C., Røe, M., & Caspersen, J. (2016). *Elevundersøkelsen 2015 : Analyse av Elevundersøkelsen 2015*. Retrieved from https://samforsk.no/Sider/Publikasjoner/Elevunders%C3%B8kelsen-2015--Analyse-av-Elevunders%C3%B8kelsen-2015.aspx
http://hdl.handle.net/11250/2415729
Wendelborg, C., Røe, M., & Federici, R. A. (2014). *Elevundersøkelse 2013 : Analyse av Elevundersøkelsen 2013* (978-82-7570-373-4). Retrieved from http://samforsk.no/Sider/Publikasjoner/Elevundersøkelse-2013.aspx
Wooldridge, J. M. (2010). *Econometric Analysis of Cross Section and Panel Data*. Cambridge: MIT Press.

Table A1: Input – output, and impact

Context	Input	Activities	Output	Impact	
				Short-term	Long-term
Rapid expansion of school health service New national guidelines for school nurse services Revision of education act	Funding Manual for how to structure collaboration between school and school nurses (meeting series) Guide for working with learning environment	Workshops Meeting series between school and school nurses	Increased presence of school nurses at each school Minutes from regular meetings between school leaders and school nurses Joint plan between school and school nurse on how the increased school nurse resource is to be used Local school plans for improvement of the school learning environment	Improved learning environment Increased well-being of students Reduced absenteeism Increased school belonging *Increased focus on teaching for teachers* *More structured and systemic collaboration between school and school nurse*	Learning outcomes Increased academic performance

Italic = investigated in the implementation and process evaluation