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PAPER

Factors Influencing the Implementation of Data-Driven Techniques for Students' Mental Health

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ABSTRACT

Data-driven methods are being implemented in many schools around the world to improve education. In this study, two schools were studied to investigate how they implemented data-driven methods for the monitoring and improvement of the well-being of their students. These schools were part of a Swedish national program where 15 schools participated to use data on both classroom, school, and system levels for school improvement. We identified five factors that influenced the implementations, namely data collection and analysis, frequency, anonymity, involving students, and organizational changes. We conclude that continuous and frequent data collection provided insights on students´ well-being that cannot be achieved without systematic data collection. Since this kind of data collection can be time-consuming, dedicated digital tools can be used to automate data collection and analysis. These tools can also provide a better basis for decision-making since it is easier to connect and visualize data. We also conclude that the European Union's (EU) General Data Protection Regulation (GDPR) is important when using student data, and there is a need for national guidelines on how to use data securely and efficiently in schools.

KEYWORDS

data-driven decision making, data-based decision-making, data use, frequent data collection, mental health, General Data Protection Regulation (GDPR)

1 INTRODUCTION

Mental health among young people has been discussed as a challenge in Sweden and similar countries. According to Beckman and Hellström [1], self-reported mental health problems have more than doubled in Sweden for children aged 10–17 years in the last decade. Other western countries have witnessed similar increases [1]. Mental health has been defined by the World Health Organization as "a state of emotional and social well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively or fruitfully, and is able to make a contribution to his or her community" [2].

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The school environment has been identified as a place where we can support children's mental health since education is mandatory and youth spend a lot of time in school [3–4]. School mental health support includes a broad array of services used in schools to support the well-being of students and their learning (e.g., student assistant teams, social and emotional learning services, and special needs education) [5]. Many systems have been suggested for supporting young students' mental health, and many of these use a multi-tiered system of support. For example, on tier one, there are services to prevent mental health issues on a broad basis. Tier two is more selective towards students at risk of mental health issues. Finally, tier three is more intensive toward students with the greatest needs [6].

Another reason for schools to support students' mental health is the double-sided correlation between mental health and learning outcomes. Students with problems with mental health tend to have problems in school. Students with problems at school also often exhibit mental health problems [7]. Therefore, the Swedish National Agency for Education [8] stated that education should promote the health and well-being of all students.

There have been studies on how to use existing information and data in school-based activities that promote mental health [9–10]. Data-driven decision-making (DDDM) has been proposed as a means to systematically improve schools, and DDDM has been applied in many different areas, including didactical aspects, professional development of teachers, absenteeism, mental health, goal fulfillment, school organization, and changes to curricula [11–13].

According to previous studies, the timeliness of the data received is critical to whether the information obtained from the data is actionable or not [14]. If the data are collected and not made available immediately, the data may become outdated and difficult to properly use in later decision-making [15]. It is also important to collect data continuously since this makes it possible to act upon data without delay. For example, Bernhardt [16] argued that it is not enough to collect data on a single occasion. Cohen-Vogel [15] stated that continuous school improvement should be integrated into the daily work of organizations; it cannot be treated as something that takes place besides daily work.

Relatively few studies have examined how teachers and principals approach mental health with data-driven methods [9–10]. It is important to understand how teachers and principals approach mental health to effectively implement data-driven practices in schools. To better understand how data-driven methods might support schools to improve students' well-being, the present study examined the implementation of two different data-driven methods to improve the well-being of students in two Swedish schools. The following research question guided this study:

– What factors influence the implementation of data-driven techniques for the improvement of students' well-being?

2 METHODS

2.1 Context

The two participating schools in this study were part of a national research and development program led by the Swedish research organization *Ifous*.[1] The aim

[1] www.ifous.se

of the program was to develop knowledge about how schools can use data to improve the quality of education. There were a total of six school organizers participating in this program: four municipality organizers and two organizers of independent schools. Each school selected a problem statement they wanted to investigate with a data-driven approach. In each school, a development group was formed, consisting of staff on different levels and positions depending on the nature of the problem. This multiple-case study focused on two participating schools that wanted to monitor and improve their students' mental health using data-driven methods.

School A was a secondary private school in southwest Sweden. The school had around 200 students distributed on three theoretical programs: social studies, economics, and science. This school wanted to educate students who can navigate in a constantly changing world and tackle problems posed in the future. They wanted the students to take an active role in our future democratic societies and to be prepared for challenges and unforeseen events. This school had been working with action research for a long time and found data-driven school improvement to be a good complement to this approach.

School B was a municipal K-9 school with around 750 students located outside of Stockholm. They wanted their students to have "strong roots" to stand steady with enough confidence to "try their wings." In this school, leaders had implemented the "spiral of inquiry" [17] as a method to develop their organization's systematic quality. They had been using this method for many years and wanted to develop this method further by increasing the use of data.

Both schools had motivated students according to the personnel in the schools but had problems with students who put too much pressure on themselves. Both schools wanted to find ways to identify students in need of intervention at an early stage and possibly foresee some future problems for their students. Both schools were very familiar with different information and communications technologies (ICT) tools and worked primarily in the Google environment. None of the schools had any specific tools designed for data-driven school improvement at the beginning of the program.

2.2 Participants

In school A, there was a central process leader, one assistant principal, one local process leader, and three head teachers who formed the development group. The development group of school B consisted of a process leader, the principal, one assistant principal, three head teachers, two teachers, and one special education teacher.

2.3 Data collection

This study used different data sources accessed for three years to get a deep understanding of the processes and decisions made during these projects. The following data were used: 1) project plans were collected at the beginning of the project; 2) five PowerPoint presentations were held at seminars; 3) semi-structured interviews were performed; 4) one focus group was held with process leaders and another focus group was held with all the participants at a seminar; and finally, 5) a written report was collected at the end of the program. These data collections are summarized in Figure 1.

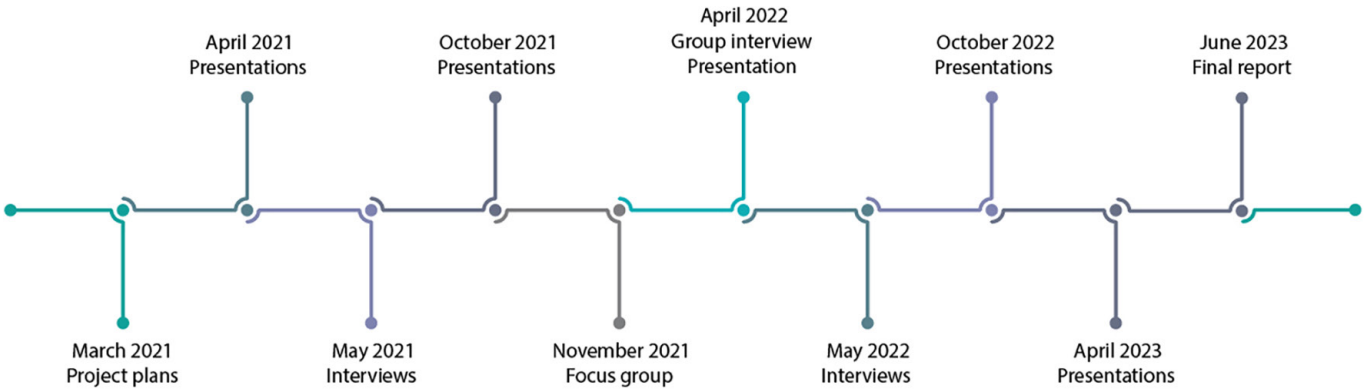

Fig. 1. Timeline of data collection

School A. At the beginning of the program, this group wrote a project plan where they described their project. After the project plan, a semi-structured interview was performed with the process leader of the school to understand how they had planned their project. At the seminar in April 2022, a group discussion was organized where the assistant principal discussed their project with other participants. In the second year, an interview with the assistant principal was conducted to get an understanding of the progress of the project. During the program, this school gave several presentations at the seminars to report on the progress in their project. At the end of the project, a report was produced to summarize the work on the project.

School B. Here, also, a project plan was written in the first year where the school described their project. In the second year, an interview with the principal of the school was conducted to understand the progress of the project. The process leader and the principal both participated in a group discussion at one of the seminars. During the program, this school gave several presentations at the seminars to report on the progress of their project. At the end of the project, a report was produced to summarize the work on the project.

2.4 Data analysis

After the interviews had been performed and recorded on Zoom™, they were transcribed verbatim according to Kvale [18]. The transcriptions and the other collected data were analyzed with thematic analysis according to Braun and Clarke [19]. They proposed a six-phase analysis where the first step is to (a) get familiar with the material by reading and re-reading and then (b) generate initial codes. In the next phase, (c) the codes are sorted into potential themes, and these themes are then reviewed (d) to verify that the themes correlate with the data. Once this is done, the themes are defined and named (e), and the story that the analysis tells will be refined. Finally, (f) a scholarly report of the analysis is produced that relates the analysis to the research question(s). The qualitative data analysis software QDA miner lite™ was used to perform the analysis. Respondent validation was used to validate the analysis [20], thereby confirming the findings of this study.

2.5 Ethical considerations

All interviewees and participants of focus groups were given written information about the purpose of the study, and the respondents gave their informed consent

before participating in this study. All participants in the program were informed in advance that project plans and presentations uploaded on a common folder would be used as data collection by the researchers. It was optional to participate in the focus group discussion, and the interviewees were selected after they had volunteered to participate in an interview.

The data from the project plans and presentations were collected at the group level and were therefore anonymous. All individually collected data through interviews were anonymized after analysis. The collected data were stored on secure servers or on encrypted hard drives to prevent unauthorized people from interacting with the data.

Moreover, this study focused on how the schools worked in a data-based way to monitor students' mental health. Mental health is sensitive information, but this study did not investigate the students' mental health but rather the processes of the schools to manage and support the mental health of their students.

The main author of this paper also played the role of process leader in school B. This role conflict might raise ethical concerns, including consent, the use of insider knowledge, and the maintenance of confidentiality [21]. Therefore, extra considerations were taken on the positionality of the researcher in this study.

3 RESULTS

In this section, we describe how the groups at the two schools implemented the data-driven methods to monitor and improve the well-being of their students.

3.1 Factors influencing implementation

The two schools both used different and, at times, similar implementations of data-driven methods. This study identified five factors of these implementations that were found important, including data collection and analysis, frequency, anonymity, organizational changes, and involving students.

Data collection and analysis. The first factor was data collection and analysis, and both schools collected existing data from their Google environment in the beginning of the project. They wanted to look for trends that could indicate mental health issues, such as students handing in assignments late or spending too much time on tasks. This proved to be difficult since it was difficult to get the data they needed from the system. For example, in school A, they had not set up the data system with school improvement in mind.

> *Despite collaboration with competent people in data management, it proved difficult to access the school's accumulated Google data in the form that the school wanted.*
>
> —Process leader at school A

Another problem found in school B when they explored different tools that could be used to aggregate and analyze their data was that these tools were prohibited from use in Sweden due to the European Union's (EU) General Data Protection Regulation (GDPR) since they stored data outside of the EU. To overcome some of these challenges, both schools decided to use surveys and interviews to collect data on their students' mental health and skip Google data. The Datateam model [21] was

used in both schools (A and B) to work with data-driven school improvement in a systematic way.

Even though both schools learned a lot from these surveys and interviews, it became obvious that this approach was not sustainable. The collection and analysis of data were too time-consuming and required ICT skills that not all the teachers possessed. For instance, the process required skills in Microsoft Excel to produce the graphs and timelines used for the analysis. Therefore, both schools started to look for a solution that could make the process more effective and less dependent on individual teachers.

Frequency. In both schools, there was a discussion about the frequency of data collection. If the data were collected frequently, it is possible to obtain data of high resolution, and it was possible to see trends over one or several semesters, both for individual students and the whole school. These trends would make it possible to adjust processes to reduce stress. However, if the data were collected too often, there was a risk of survey fatigue, which could decrease data quality. For instance, if the students did not take the survey seriously, it was difficult to take proper actions based on the data. In school A, mentors administered the survey once a week, and in school B, four times a year, including two times during the autumn semester and two times during the spring semester.

> *We started to collect data with a rather large survey to map the well-being of our students, and that gave us a snapshot. When we got the results and we could see patterns after 6 weeks had passed, a lot had happened since the measurement. We decided that each mentor should have small reconciliations with their mentor students to collect data about their mental health, which gave us an understanding about the current situation of our students.*
>
> —Assistant principal at school A

In the beginning of the project, both schools included a high number of questions in their surveys and interviews. At the end, they wanted to reduce the number of questions asked and identify the most relevant questions that provided the information necessary to act. This reduced the amount of time spent on analysis. This also made it possible to increase the frequency of data collection. Both schools experienced that the quality of data increased when the students provided more truthful answers after the number of questions was reduced.

Anonymity. In school A, the survey was not anonymous, and their mentor could see the results of individual students. However, the principal could only see aggregated data. This enabled the teacher to intervene with both individual students and on a group level. This also made it possible for the teacher to survey the needs of every student and make interventions in single student cases. Simultaneously, the teachers collected data on a systematic level, which enabled interventions on a school level. Using this data, they could also investigate any discrepancies between how students viewed themselves and the teachers' views of individual students. When using non-anonymous data on students' mental health, the personnel realized it was important to maintain good relations with the student and mentor if the student had to reveal personal information about themselves.

In school B, the teachers used an anonymous survey, but they could see each student's year in school and the student's gender. They did not have any open questions since the students could reveal personal information, which would make it possible to identify the student. Yet, this could be a violation of GDPR, according

to a municipal lawyer, and were thus not used. Thus, it was impossible to analyze the data on an individual level, so this school analyzed the results on gender and grade level.

Involving students. The students at school A wanted to see their own data, and the tool that the school used allowed this to enhance the students' motivation to complete the surveys. The students thought that these data could provide them with insights about what was affecting their mental health. These insights could make it possible for the students to regulate their own mental health. This form of self-regulation could be beneficial but also problematic. It appeared to help students understand that experienced stress was connected to intense schoolwork and that it was not permanent. Conversely, it could be discouraging for the students to see their mental health compromised, and this could lead to resignation among students. It depended on how it was presented to the students and how they received the information.

There was also a discussion about whether the students should be allowed to compare their own results with peers. A potential advantage was that it gave the students a sense of not being alone with their stress. If they saw that, other students also experienced stress, it could be a relief. However, for some students, it was disheartening if their mental health was constantly lower than their peers'.

In school B, there were discussions with the students about the surveys to get a better understanding of the results. For instance, the students in year 7 shared that they did not trust their teachers, and this was worrying since this influences learning. However, in the discussions with the students, it became clear that they did trust and like their teachers, but they had not gotten to know them since this was the first semester with the new teachers. These discussions also revealed that these students did not want to discuss problems with their teachers since they thought it could affect their academic grades. These discussions improved the students' motivation to complete the surveys since they felt confident that the teacher used the results beneficially.

> *We got some results that surprised us. These are things that we would not have seen if we had not asked these questions in the survey. It's not that the questions gave us all the answers, but the answers became a basis for asking the students, "What do you think about this?"*
>
> —Principal at school B

In school A, the teachers could see all the students (they did not miss some students), and they had a better understanding of their students' mental health; sometimes individual students estimated their well-being higher or lower than the teachers expected. This led to productive discussions between the students and their teachers. The systematic collection of data on well-being also led to earlier interventions; it made it easier for the mentors to identify students who needed support.

In school B, they were able to capture new aspects of their school and their students, which led to new questions in the dialogues with students. There was no data from the individual students since the survey was anonymous. Therefore, they worked on a school level to recognize obstacles to learning. In the middle of the spring semester there was always a dip in the students' mental health (see Figure 2), and they wanted to find out why. They had several hypotheses, such as there being too many tasks at this time of the year or sicknesses were causing some students' absences in February and March. The school could not find the reason behind this during this Ifous program, and they would investigate this further.

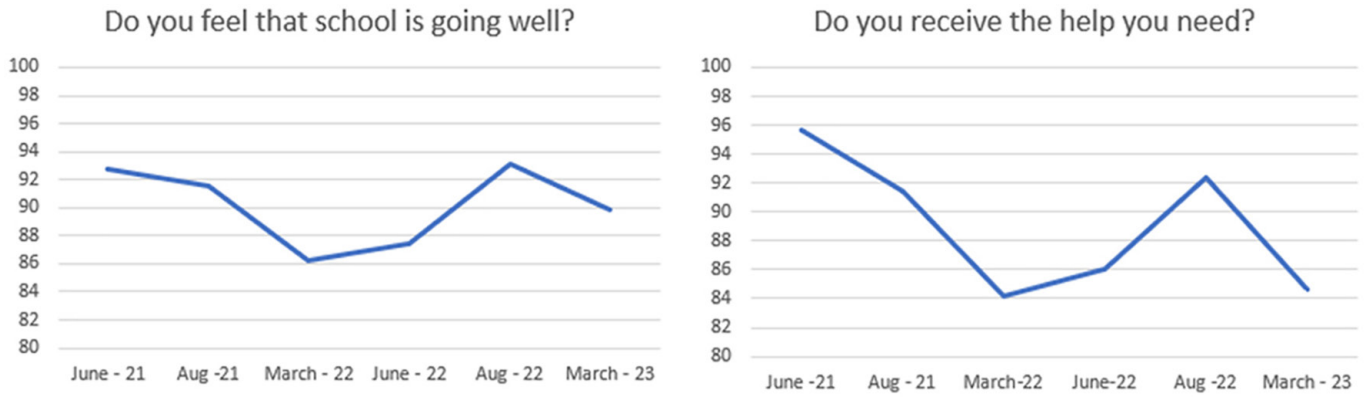

Fig. 2. Results from the survey in school B and attendance data

In both schools, the teachers learned new things about the mental health of their students. One of the first insights in both schools was that the students were experiencing less stress than they had anticipated. The students experienced that it was sometimes "a lot of work," but it did not bother them too much.

At the end of the project was an anticipation that both schools should be able to see the connection between the mental health of the students and how they learned best in terms of what factors contributed to the students' learning and what factors contributed to the students' experiences of stress. In school A, they wanted to compare the data obtained from the survey about their students' mental health with the data on academic achievement. When this data was combined, it appeared possible to understand how mental health and student learning correlated with each other.

Organizational changes. It was a clear intention of both schools to adjust the organization of their school based on their insights from data collection and analysis. There was a discussion about changing the schedule and reviewing the calendar for assignments and tests to reduce the stress on students. There was also an understanding that the personnel had a responsibility to act on the collected data. In both schools there was a parallel process of defining the different roles in school more precisely: What are the responsibilities of mentors, teachers, and student health workers to intervene more effectively?

In school A, the mentors for the students had identified that they did not have the right information that they needed to help their students, e.g., test results from different subjects and the well-being of their students. The mentors also experienced that they did not meet with all their students; some students received a lot of help, whereas others did not. They used the survey to plan the mentor time and improve the discussions with the students. They wanted to use the results from the survey to plan their mentor time, which they had three times a week. This resulted in new and improved processes in the decision-making between mentors, teachers, and student health workers.

In school B, the teachers had problems with the students in one grade where the students did not learn as expected, and there were many conflicts between the students in this grade level. It became obvious from the surveys that this group of students were afraid to fail, and this was an obstacle to learning for the students. The students also experienced that they did not receive the support they wanted. This was surprising for the personnel since they had experienced this group of students as "confident." After the survey, the personnel made some changes, such as facilitating discussions with the students about learning processes and the necessity to "fail to learn." This grade also received extra personnel to support the students, such as student assistants. Another intervention was to offer breakfast for the students since many of them did not eat breakfast at home. There was also a discussion

in school B about periods where students experienced stress, such as transitions between years 3 and 4 and when the students received their first grade. The teachers wanted to prepare their students before these periods to reduce stress.

Alongside the data collection via the survey, there was an inventory of what kind of data the student health collected about their students: Was it the right information, or was there a need to collect more data, and were some data unnecessary to collect? The student health workers also wanted to know if there were any themes in the cases that the school curator and school psychologist were working with. From these themes, they wanted to see if it was possible to intervene on a group level instead of focusing on individual students.

4 DISCUSSION

In this study, we examined how two different schools implemented data-driven methods to monitor and improve their students' mental health. We sought to understand how the schools worked and how different implementations might benefit the results of the projects. We wondered what factors enabled or hindered these implementations, and five factors were identified: data collection and analysis, frequency, anonymity, involving students, and organizational changes.

Both schools wanted an effective collection and analysis of data to make interventions and organizational changes. A lot of data was being collected through different forms of surveys, which could lead to survey fatigue if not implemented properly. Much data was stored in different systems (e.g., student information systems, learning management systems), which had the potential to be used for school improvement, but it was difficult to extract and/or present in ways that made it possible to act upon [22]. In this study, school A adopted a dedicated tool to collect data, analyze the administered survey, and provide insights automatically. School B wanted to use the same tool, but a municipal attorney did not allow this due to GDPR issues. This tool made it easier to collect data and provided automatic insights presented in a dashboard. Other schools are using other tools such as data warehouses to visualize and analyze data [22]. At the district level, some districts have implemented value-added models to analyze test score data and follow students' learning trajectories [23].

The collection and analysis of data from the surveys in the present study led to discussion about the roles of their personnel and other organizational changes. In both schools, it was clear that changes in organization based on the outcomes of the data analysis were necessary. There was a clear need to clarify the roles of mentors, teachers, and student health workers to make effective interventions. The clarification of roles also led to the improvement of processes to support the students' mental health, which made it possible to work more proactively with the students. Both schools viewed this as an important factor for success in their work with their students' well-being. This is an advantage with a data-driven approach—it makes the current situation clearer and therefore easier to understand and ultimately take informed action. This was previously discussed by Cerratto Pargman and McGrath [24], who claimed there is a lack of research on interventions from educational institutions.

There were also discussions in both schools about how frequently the data should be collected. It was clear that data had to be collected regularly and systematically to see trends and make necessary changes in the schools' organization. It was also clear that both schools could reveal interesting findings by using a data-driven approach. A more frequent collection would allow the schools to see patterns and trends otherwise impossible to recognize with a less frequent collection. This finding aligns with

previous research [25–26]. Grunow and Hough [26] claimed: "Continuous improvement needs both more frequent and deeper data in order to catch problems while there's still time to turn them around."

In school B, the personnel administered the survey, also called 'pulse surveys,' four times a year. Pulse surveys are short surveys that complement annual surveys to identify problems early and intervene before problems spread [27]. However, if the frequency of the surveying increases and nothing happens with the data, there is a risk that the process of the survey is seen as negative. To use the data obtained from pulse surveys in a positive way, it should lead to a dialogue [27]. Winton and Palmer [28] discussed more frequent pulse surveys and stated that they can provide more timely and actionable data. In school A, the mentors administered the survey once a week, and to get a positive response from the students, they had a continuous dialogue with the students.

In this study, both schools used a short survey to increase the frequency of how often the surveys were conducted. This gave a more accurate view of the students' experience of well-being. If the surveys were conducted once a year, you got a snapshot of the present state, yet this snapshot did not represent the whole year. It was, however, critical that the survey questions provided the data necessary to act upon. Previous research had shown that a short survey can be used instead of a longer one if the "right" questions are asked [29–30]. Both surveys were validated and tested for reliability.

There was also a concern about how to administer surveys that collect sensitive information about students' mental health since participants may be reluctant to provide deeply personal information. A meta-review by Harenberg et al. [31] showed that an anonymous method identifies twice as many mental health issues compared to non-anonymous methods. Is the higher number more correct, or is this a case of overreporting [32]? However, medical testing indicates that anonymous methods are more accurate [33]. Durant et al. [34] studied the relationship between anonymous assessment and data quality and concluded that data quality improved with anonymous assessments. A recent study [35] states that mental health surveys can be valid in both survey formats but with a tendency for the participants in a non-anonymous survey to endorse responses that are socially desirable (i.e., social desirability bias) [35]. A non-anonymous survey enables interventions on an individual level but can lead to decreased data quality on the group level. Therefore, if individual-level interventions are important, a non-anonymous data collection is recommended. Otherwise, an anonymous collection of data is recommended.

Results and the survey insights were discussed with the students in both schools to better understand the results and involve them in solutions. The students were also allowed to see their own results to increase their motivation to engage in the methodology. If the student's motivation for the survey was low, it could lead to satisficing, a phenomenon where respondents fail to put forth their best efforts or actively provide false answers [36]. Satisficing can have a moderate effect on data quality. Other researchers have also found a relationship between satisficing and reliability and validity [37]. Therefore, it is important to include students to improve the quality of data collection and analysis.

The GDPR and ethical issues had an impact on the work in the projects. In school B, there were restrictions on what kind of questions were allowed to be asked, according to a municipal attorney. It was, for instance, not allowed to ask open questions since they could reveal the identity of specific students, and data on mental health is sensitive information. Previous studies had found that open-ended questions elicit more in-depth information compared to standardized questions [38]. This limits the information that these surveys could provide principals and teachers with if they are only allowed to use multiple-choice questions.

5 CONCLUSION

In this study, we can conclude that a systematic, continuous, and frequent collection of data can allow educators to see patterns and gain insights on students' mental health situations, insights not possible without data collection. This process is, however, time-consuming and requires skills that not all educators possess. It is therefore important to use tools that can help automate this process so teachers can focus on actions based on the insights gained from data collection and analysis, as school A in this study did. This can provide better insights since it makes it easier to connect different data and make visualizations and other representations. It is, however, difficult to determine the appropriate frequency for data collection; it depends on the purpose and local conditions.

In both schools, the data-driven approach revealed new insights about their students, which resulted in new questions and improved dialogues with students. These dialogues improved the quality of the data collected, which led to better interventions. If it is important to identify students at risk, we recommend using non-anonymous surveys. Otherwise, an anonymous survey can provide data of higher quality. Also, it appeared necessary to adjust the organizations to act effectively on the insights gained from the data collection and analysis. When dealing with student data, it is critical to have guidelines for how the data will be used since this affects how teachers and principals can use the data effectively.

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