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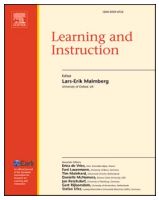

Beyond academics: Links from teaching practices in Swedish schools to students' achievements and mental health complaints

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ABSTRACT

Background: Despite extensive research on the relationship between teaching practices and learning outcomes, limited attention has been given to their potential links with students' mental health.
Aims: This study investigates the relationships between three teaching practice types – teacher-centered, student-centered, and student-dominated – and both student mental health complaints and academic achievement. It furthers explores variations in these associations based on students' socioeconomic status (SES).
Sample: The analysis includes 4573 grade 9 students (aged 15–16 years) in the Swedish comprehensive school system.
Methods: Employing structural equation modelling techniques, we analyze a dataset comprising students' cognitive test scores, their perceptions of classroom processes, self-reported mental health complaints, as well as register data on teacher-assigned grades and parental education.
Results: Teacher-centered practices are positively associated with academic achievements but lack robust links with mental health complaints. Conversely, student-centered practices are positively associated with academic achievements and correlate with lower mental health complaint frequencies. However, student-dominated practices demonstrate poor relationships with both mental health and academic achievements. Limited variations based on students' social background reveal only two differing associations between low and high SES students: teacher-centered teaching shows stronger academic achievement associations for low SES students, while student-dominated teaching is more adversely linked to low SES students' mental health.
Conclusions: The results affirm the benefits of both teacher- and student-centered teaching practices for academic achievement while cautioning against excessive self-directed teaching. Importantly, the study highlights the role of instructional approaches in shaping not only academic outcomes but also students' mental health.

Recent years have seen students' mental health rise as a priority on the education agenda, recognizing the significance of the school environment for student well-being (OECD, 2017; Montt & Borgonovi, 2017; Wang et al., 2020; Aldridge & McChesney, 2018). At the core of the school environment are teaching practices, which encompass the specific activities and methodologies through which teachers organize instruction, deliver curriculum content, and guide how students engage in their schoolwork–essentially shaping how students are taught. Different teaching practices trigger, foster or create space for distinct interactional dynamics, influencing various developmental outcomes (Granström, 2006). Despite their significance, existing research has almost exclusively focused on their links with academic outcomes, such as motivation and grades (Wijnia et al., 2011; Olivier et al., 2020; Korbel & Paulus, 2018; Alfieri et al., 2011; Perry et al., 2007; Lerkkanen et al., 2016), leaving a gap in understanding how these practices relate to non-academic outcomes, such as students' mental health.

In Sweden, both the mental health and academic achievements of school-aged children gradually deteriorated during the past few decades (PHAS, 2018; Skolverket, 2009). These declines, partly due to changes in school organization and teaching practices, were influenced by reforms initiated during the 1990s (PHAS, 2018). Among other adjustments, there was a shift from 'traditional' to more individualistic forms of teaching, labeled as 'independent/individual work' (Giota & Emanuelsson, 2018; Skolverket, 2009). This shift resulted in students assuming greater responsibility for their own learning, while teachers adopted more of a facilitator than a leader role (Carlgren et al., 2006;

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Eriksson, 2009). The consequent change in students' responsibility for their learning may have implications for the recurring reports of mental health complaints among school-aged children (Skolverket, 2009).

However, the exact links between teaching practices and students' mental health complaints remain uncertain. While several school-related factors and their relationships with students' mental health have been examined (as seen in systematic reviews by Wang et al., 2020; Aldridge & McChesney, 2018; Kidger et al., 2012), there is a dearth of research addressing the role of teaching practices, despite teaching being the central activity of any school, occupying most of students' time. To start addressing this research gap, in this study, we explore the associations between different teaching practices as perceived by students in grade 9 of the Swedish comprehensive school, and students' mental health complaints and academic achievements. Additionally, aligned with the longstanding ambition of promoting equality in the Swedish education system (Björklund et al., 2003), the study focuses on social inequalities. It investigates variations in these associations based on students' social backgrounds, offering insights into potential disparities in educational experiences among different socioeconomic groups. These findings can inform educational policy, curriculum design, and teacher training.

To guide our investigation, we formulated the following research questions: How do teacher-centered, student-centered, and student-dominated teaching practices in grade 9 of the Swedish comprehensive school relate to students' academic achievements, specifically in terms of grades? What are the associations between these teaching practices and students' mental health complaints? To what extent do these associations vary based on students' social background?

1. Background and previous research

1.1. Teaching practices

Teaching practices have been a focal point of educational research for decades, seeking to optimize learning environments for students. Different practices have evolved over time, broadly falling into two main categories: teacher-centered and student-centered practices (Bernard et al., 2019; Hmelo-Silver et al., 2007; Kirshner et al., 2006; Lerkkanen et al., 2016). In our study we identify and elaborate a third approach, which we term as student-dominated practices. This approach, while bearing similarities to student-centered methodologies, branches out as an intensified extension (cf. Kirschner et al., 2006; Lerkkanen et al., 2016). What makes this approach especially intriguing is its alignment with the increased responsibility observed among students for their own learning, a trend particularly noted in Swedish schools following the extensive educational reforms of the 1990s (Carlgren et al., 2006; Eriksson, 2009; Giota & Emanuelsson, 2018; Skolverket, 2009). This shift towards heightened student autonomy in managing their own schoolwork with limited levels of teacher support has been suggested as a factor contributing to Sweden's decline in international knowledge assessments (Skolverket, 2009). This approach merits its distinct categorization and analysis.

Teacher-centered practices are rooted in 'traditional' educational models, emphasizing the teachers' central role in guiding the learning process. Such practices are characterized by the teacher primarily leading and delivering lectures and routine evaluations to assess student progress, echoing earlier educational trends where rote memorization and direct instruction were standard (Magliaro et al., 2005; Stockard et al., 2018). Formal testing, in this context, can be seen as a component of the structured approach that teacher-centered instruction tends to have, where an emphasis on testing reflects a focus on learning factual knowledge (Cuban, 2016). Historically, these practices resonated with the more conservative, structured educational systems where the educator was the primary knowledge bearer, imparting information to students in a top-down manner (Magliaro et al., 2005; Stockard et al., 2018). Such practices can be identified through classroom indicators such as the dominance of the teacher's voice with statements like, 'The teacher talks most of the time during lessons', and periodic standardized tests. Grounded in behaviorism, it positions students as largely passive receivers of knowledge (Daniels & Shumow, 2003).

Student-centered practices emerge from progressive educational philosophies, underscoring the learners' integral role in the learning process (Tobias & Duffy, 2009). These practices are characterized by fostering collaborative environments where students engage in group activities, discussions, and peer learning (Tobias & Duffy, 2009). Individualized and adaptive learning strategies, tailored to meet diverse learning styles and paces, characterize this approach, shifting from a conventional content delivery model to more experiential and inquiry-based learning (Kirshner et al., 2006). Historically, these approaches were a counterpoint to the stringent, teacher-driven models, advocating for a more interactive, student-driven classroom environment. Identifiable classroom indicators for such practices include collaborative 'Working in groups', sessions marked by 'Teacher and students discuss together', and active student participation in 'Planning instruction' (Giota & Emanuelsson, 2018). Rooted in constructivist theories of learning, it views students as active participants in the knowledge-building process, rather than passive recipients (Daniels & Shumow, 2003).

A conceptual extension of student-centered approaches, student-dominated practices amplify student autonomy to the point where educators take a minimalistic role in the learning process (Kikas et al., 2016). Such practices are characterized by activities where students independently source information and drive their learning process. They echo a radical shift from conventional pedagogies, embracing ideologies that prioritize experiential and constructivist learning methodologies (Tobias & Duffy, 2009; Kirshner et al., 2006). Identifiable classroom indicators for such practices include students 'seeking information independently', taking charge to 'plan and execute their tasks', and showcasing their personal projects or assignments. This approach, while allowing for considerable student autonomy in the learning process, also places a significant responsibility on the students for their own learning, potentially lacking the structured guidance found in the other two practices (Stipek & Byler, 2004; Woolfolk Hoy & Weinstein, 2011).

The categorization of these three teaching practices can here be seen as 'ideal types' in the Weberian sense. Ideal types are abstract constructs that help categorize complex real-world phenomena. In this vein, the three teaching practices—teacher-centered, student-centered, and student-dominated—can be understood as ideal types. Each category distills the essence of a pedagogical approach, classifying dominant characteristics of different teaching practices. Teacher-centered practices epitomize the traditional model where teachers act as the primary source of knowledge. This ideal type captures the essence of a hierarchical, structured, and directive form of teaching. Student-centered practices, in contrast, highlight the pedagogical shift towards individualized and participatory learning. This ideal type represents a more interactive, adaptive, and collaborative classroom environment. Student-dominated practices take the constructivist approach to its logical extreme, placing almost all agency in the hands of students. As an ideal type, it underscores maximum student autonomy, representing a teaching scenario where students dictate the pace, content, and structure of learning.

1.2. Teaching practices and student learning outcomes

Empirical research into these teaching practices and their effects on student learning outcomes have revealed distinct patterns. Teacher-centered practices tend to enhance students' factual knowledge and routine problem-solving skills (Algan et al., 2013; Beitenbeck, 2014). For example, an increase in lectures at the expense of problem-solving activities has been associated with improved performance in standardized problem-solving tests (Schwerdt & Wupperman, 2011). However, it is important to note that such tests might not fully capture the broader

skill set fostered by student-centered teaching (Beitenbeck, 2014).

In contrast, student-centered practices have demonstrated a positive impact on a wide range of learning outcomes (Wilder, 2015; Furtak et al., 2012; Seidel & Shavelson, 2007). Nevertheless, certain student-centered approaches, particularly those with less guided teacher instruction like inquiry-based teaching in science education, have been associated with worse educational outcomes when compared to teacher-centered approaches (Teig et al., 2018; Pokropoek et al., 2018). This highlights the non-linear relationship between some student-centered practices and student learning and underscores the crucial role of teacher guidance. When teacher guidance is minimal, students are often left to independently navigate their learning experiences (Kirschner et al., 2006). This self-directed exploration, akin to what previous research has termed high-intensity student-centeredness (Teig et al., 2018; Pokropoek et al., 2018), aligns with our conceptualization of student-dominated teaching.

In summary, previous research indicates that both teacher-centered and student-centered practices offer benefits for diverse learning outcomes (Beitenbeck, 2014; Algan et al., 2013; Wilder, 2015). However, the effectiveness of student-centered practices may be contingent on the degree of teacher guidance, as minimal guidance can potentially hinder the learning process (Lazonder & Harmsen, 2016).

1.3. Mental health

Mental health is a multidimensional phenomenon, and mental *ill* health is a term encompassing various adverse conditions of varying severity and duration within this broader conceptual space (see e.g., Granlund et al., 2021). They range from relatively minor mental problems, such as anxiety and gloominess, to severe problems that meet the criteria for diagnosed mental illnesses, such as depression and schizophrenia. Mental ill health is often divided into two categories: internalized (e.g., anxiety and depression) and externalized (e.g., excessive impulsiveness and aggressiveness) (Gustafsson et al., 2010). In the present study we focused on two dimensions of internalized mental ill health: emotional distress and psychosomatic problems. Common indicators of emotional distress are depressed mood, sense of hopelessness, feelings of failure, irritability, and social withdrawal (Power, 2013). Common indicators of psychosomatic problems are headache, backache, stomachache, nervousness and feeling low (Currie et al., 2009).

Reports of deteriorating mental health among school-aged children in Sweden often emphasize measures of psychosomatic complaints (Currie et al., 2009; PHAS, 2018). In this paper, we employ similar items to measure the same dimensions of mental health, as addressed in these reports. Consequently, our study contributes to understanding of links between the teaching-learning environment in Swedish schools and the specific types of mental health complaints among students highlighted in these reports.

1.4. Teaching practices and student mental health complaints

Prior research on links between teaching practices and student mental health complaints is limited (Gustafsson et al., 2010), as previously mentioned. Nevertheless, both theoretical principles and empirical observations suggest an association between these constructs. In this study, we propose a conceptualization for understanding this relationship, drawing on established theories that emphasize the role of environmental conditions for human development (Deci & Ryan, 2000; Eccles & Midgley, 1989). Specifically, we posit that teachers' instructional practices have a significant role in shaping classroom dynamics, which, in turn, influence students' social and learning environments.

According to stage-environment fit theory, optimal development is thought to occur when the classroom environment adequately fits the developmental stage and psychological needs of individuals (Eccles & Midgley, 1989; Eccles & Roeser, 2011), such as the mid-adolescent students included in our analysis. Environments that neglect or frustrates individuals' psychological needs may contribute to adverse developmental outcomes, including poor academic achievement as well as socioemotional and mental ill-being (Eccles & Midgley, 1989; Ryan & Deci, 2000). According to self-determination theory, people have three basic psychological needs – for autonomy, relatedness, and competence – which become particularly salient in adolescence (Ryan & Deci, 2000). As core characteristics of the teaching practices considered here inevitably influence the psychosocial teaching environment (e.g., by permitting or requiring varying degrees of autonomy or relatedness in the classroom) they may have different effects on not only students' learning but also their mental health.

Beginning with teacher-centered practices, a core component is the teacher's transmission of information, commonly through lecturing. Lectures for the whole class efficiently convey content but may not accommodate all learning styles or students' individual needs. As a consequence, there is a lack of student engagement or motivation to learn (Loughlin & Lindberg-Sand, 2023). Students are often passive recipients of information that might nog align with their interests, leading to a diminished sense of autonomy and involvement in the learning process (Deci & Ryan, 2000). On the other hand, the predictability and structure might provide a sense of security and competence for some students, particularly those who prefer this mode of learning. However, the potential negative impact on mental well-being occurs when students perceive a lack of engagement or recognition of their opinions and thoughts, leading to a decrease in their motivation to learn (Granström, 2006; Rocca, 2010).

Another core feature of teacher-centered practices, in the context of our study, is formal testing. While tests are not exclusive to teacher-centered methods, they are more common due to their structured and formalized approach. In contrast, the other teaching practices we discuss often employ assessments like project presentations and alternative evaluation methods. Testing at regular intervals to examine students' comprehension or knowledge acquisition may assist teachers' assessment of their progress. Testing may facilitate students' reception of feedback on their understanding and performance, which is crucial for them to improve their learning and achievement (Hattie & Timperley, 2007). However, students tend to regard formal assessments in school as significant stress factors (Banks & Smyth, 2015; Låftman et al., 2013; Östberg et al., 2015). A strong emphasis on testing and demonstration of performance may foster a socially comparative and performance-based learning environment. Such environments can jeopardize some students' sense of competence and the relatedness between students and teachers (Baudoin & Galand, 2022; Niemiec & Ryan, 2009; Wang, 2009; Wang & Holcombe, 2010). Therefore, while testing may promote improvements in student achievement outcomes, both directly and through feedback, it may simultaneously elevate anxiety levels.

In examining teaching practices and their potential implications on students' mental health, student-centered teaching stands out prominently. A core element of this approach is group work. This promotes relatedness among peers and fosters agency, actively involving students in the learning process (Lombardi et al., 2021; Niemiec & Ryan, 2009). Secondary school students have shown a general preference for this style, particularly enjoying the inquiry-based group work aspect (Cairns & Areepattamannil, 2019; Granström, 2006; Korbel & Paulus, 2018). Moreover, allowing students the opportunity to form opinions through discussions and providing opportunities for decision-making not only augments their autonomy (Niemiec & Ryan, 2009) but also supports the student-teacher relationships (Gallo et al., 2022; Longobardi et al., 2019; Roorda & Koomen, 2020). Indeed, limited yet significant empirical evidence indicates that student participation in decision-making is positively associated with emotional health (Mager & Nowak, 2012).

Expanding on this, in student-dominated teaching practices, students are assigned considerable personal responsibility for planning and independently managing much of their schoolwork themselves (Eriksson, 2009). In such settings, if teachers place (too) much emphasis on

free choice and autonomy – manifested in the form of self-directed independent student work – without sufficient guidance, it may lead to academic and social difficulties, especially among vulnerable students (Valeski & Stipek, 2001; Walker, 2008). While some students may find self-responsibility and freedom of choice motivating, others experience stress (Östberg et al., 2015). Merely offering choice is not inherently motivating (Katz & Assor, 2007); it must be complemented by appropriate teacher support (Ruzek et al., 2016). In student-dominated practices, however, teachers often take a passive role (Kikas et al., 2016; Woolfolk Hoy & Weinstein, 2011). This dynamic can lead students to internalize failures to meet learning objectives as their own fault, attributing the shortcomings to themselves rather than to the teaching practice or school's instructional approach. Furthermore, a strong focus on individualized tasks, neglecting collaborative efforts, may deprive students of the benefits associated with collective classroom activities (Giota & Emanuelsson, 2018; Granström, 2006), potentially undermining their sense of competence and impeding the development of relatedness.

Taken together, our discussion highlights the contrast between teacher-centered and student-centered teaching practices and their potential impact on student mental health. Teacher-centered practices, particularly through lectures involving fully guided instruction and formal testing, offer a structured approach to content delivery. However, they can occasionally limit students' autonomy and exacerbate stress. Conversely, student-centered teaching, marked by group work and participatory discussions, fosters students' autonomy and relatedness. Yet, it is not without challenges. While it accentuates autonomy, it can inadvertently lead to academic and psychosocial difficulties, especially in the absence of sufficient guidance. Importantly, when students' psychological needs of autonomy, relatedness, and competence remains unfulfilled, it is theorized to correlate with mental health complaints, a primary focus of our study.

1.5. Variation in associations by students' socioeconomic background

In addition to the general decline in Swedish students' performance, particularly evident in international large-scale assessments, growing disparities have surfaced among students from different socioeconomic backgrounds (Yang Hansen & Gustafsson, 2019). This trend has been attributed, in part, to shifts in teaching methods, moving away from traditional teacher-led approaches, and the inadequacy of support for students requiring special assistance (Skolverket, 2009). These changes have elevated the significance of support from home, particularly parents' educational levels and cultural capital, in influencing individual students' academic performance (Skolverket, 2009). Therefore, it is crucial to investigate the role of students' socioeconomic backgrounds in moderating the relationships between teaching practices and academic outcomes.

While prior research has emphasized the importance of teaching practices, limited attention has been directed towards their interaction with students' social backgrounds, particularly within the Swedish context. However, one could hypothesize that teacher-centered practices, characterized by strong teacher-led instruction, may play a crucial role in mitigating the effects of limited home guidance, especially for students from less academically involved families (Lavy, 2016). The structured guidance inherent in teacher-centered approaches can provide a more supportive framework, particularly for students who face challenges navigating a self-directed learning environment.

Conversely, student-centered, and especially student-dominated practices, which emphasize autonomy, independent work, and collaborative learning, may pose challenges for students from low SES background. The self-directed learning inherent in such practices could potentially contribute to heightened stress levels and psychosomatic complaints among these students (PHAS, 2018). The expectation for students to independently set academic goals, explore and derive meaning from learning materials might be particularly demanding for individuals who lack the socialization and academic traditions needed to meet these instructional demands (Andersen & Andersen, 2017).

Research indicates a clear link between SES and mental health issues in Swedish school-aged children (e.g., Corell et al., 2022). Students from low SES backgrounds not only report elevated levels of stress and psychosomatic complaints but also have fewer coping resources to manage this stress (PHAS, 2018). The inadequacies in the Swedish education system, as suggested by the Public Health Agency of Sweden (PHAS, 2018), may contribute to the worsening mental health of Swedish youths. Therefore, it becomes crucial to explore how different teaching practices particularly in the Swedish context, may exacerbate or alleviate these challenges for students of varying SES background.

2. The current study

Given the review of the literature and the conceptual framework presented in the background section, several expectations can be formulated regarding the associations between teaching practices, academic achievement, and mental health.

It is anticipated that teacher-centered practices, with their emphasis on structured content delivery and formal testing, may positively correlate with academic achievement, particularly in terms of factual knowledge and routine problem-solving skills. However, this approach might also co-occur with increased stress and potentially higher levels of mental health complaints, as indicated by previous research on the relationships with formal testing.

On the other hand, student-centered practices, characterized by collaborative and experiential learning, are expected to have a positive association with a broader range of learning outcomes, including critical thinking and social skills. This approach may contribute to positive mental health outcomes by fostering autonomy, relatedness, and competence. However, challenges might arise if there is insufficient teacher guidance in student-centered practices, potentially coinciding with academic and psychosocial difficulties.

This latter concern is especially pertinent in our conceptualization of student-dominated practices, where the high degree of autonomy granted to students is expected to have a mixed manifestation. While these practices may empower students, an excessive emphasis on self-directed independent work without proper guidance might coincide with stress and difficulties, particularly among students from low socioeconomic backgrounds.

It is thus also expected that the experiences with teaching practices on academic achievement and mental health may vary based on students' socioeconomic backgrounds. Teacher-centered practices are likely to offer more support to students from families with lower academic experience, which can be considered as equivalent to low socioeconomic families in general. In contrast, student-centered and especially student-dominated practices may pose challenges, particularly for students from low socioeconomic backgrounds.

Building on the foundational aspects outlined in the preceding sections, this study explored the hypothesized associations within the general academic landscape of Swedish secondary education. Our specific focus was on grade 9 students, and our analysis extended beyond isolated subject domains to uncover overarching patterns in the academic milieu.

The emphasis on grade 9 students is, in part, influenced by data availability and, more significantly, by the pivotal role this academic phase plays in Swedish students' educational trajectories. Functioning as a transitional bridge between compulsory education and the subsequent stages of learning, grade 9 represents a critical phase marked by increased autonomy and unique challenges. This makes it a focal point for understanding how instructional methods may impact academic achievement and mental health.

3. Methods

3.1. Data and participants

Data sources that encompass information on multiple teaching practices, student achievement and mental health are relatively scarce. One such resource is the database generated by the Swedish longitudinal project known as 'Evaluation Through Follow-Up' (ETF). This extensive database combines survey data with administrative register data for eleven nationally representative cohorts of individuals born between 1948 and 2010 (Härnqvist, 2000). These cohorts have been longitudinally followed in collaboration with Statistics Sweden.

For our study, we focused on the cohort born in 1998. As with all ETF-samples, the initial sample of students in this cohort was drawn during their third-grade year. The original sample (N = 9549) represented approximately 10% of the total age cohort. The sampling procedure involved two steps: first, a stratified sample of municipalities was chosen, followed by the selection of school classes within each of the selected municipalities.

Data collection took place during the spring of 2011 when most students were in sixth grade, aged 12–13 years. A questionnaire was distributed through school principals to participating students, and a total of 8007 students completed all or part of the questionnaire. This survey covered various aspects of both their schooling experience and their lives outside of school. During this data collection round in the sixth grade, an aptitude test designed to measure general cognitive skills was also administered. We only used student scores from these cognitive tests from this wave of data collection.

In a second data collection round, when the same students reached the ninth grade at ages 15–16, the questionnaire was sent to each student's residential address. This version of the questionnaire, unlike the previous ones, included questions related to the students' self-assessed mental health. In total, 4573 students, with a gender distribution of 55% girls, from the original sample responded to the questionnaire in the ninth grade, resulting in a response rate of approximately 48%.

In summary, our study utilized data from the sixth grade, specifically the students' cognitive scores obtained from the cognitive tests, as well as information about teaching practices and mental health complaints from the ninth-grade questionnaire. This information was then matched with register data providing information on students' teacher-assigned school grades in ninth grade, along with details about their parents' educational attainment, obtained from Statistics Sweden, serving as a proxy indicator for their socioeconomic background.

3.2. Measures

Teaching practices. Students provided self-assessments of their classroom experiences using a five-point response scale, indicating how frequently they engaged in various activities. Following the initial question, several statements were used to create latent factors representing three distinct constructs: *Teacher-centered teaching*, *Student-centered teaching*, and *Student-dominated teaching*. The response scale ranged from "Always/Almost always" (1) to "Almost never" (5). However, the responses were reverse-coded, meaning that a higher value indicated a more frequent use of the respective teaching practice.

Teacher-centered teaching was captured by items such as "The teacher talks most of the time during lessons", "Having written homework tasks", and "Doing tests". These items were designed by the ETF and aligned with the characteristics of teacher-centered practices, as discussed above. They reflect a teaching approach with an emphasis on lecture-style knowledge transmission from teachers to students with the presence of much formal testing (Stockard et al., 2018).

Student-centered teaching was assessed through items like "Working in groups", "Teacher and students discuss together", and "Being involved in planning instruction". Student-centered teaching emphasizes the social aspects of learning, including interpersonal relations, collaboration between teachers and students, peer-learning, and student involvement in decision-making, with autonomy support (McCombs, 2010).

Student-dominated teaching was measured using items such as "Independently seeking information", "Planning and working with one's assignments", and "Presenting one's work or project". Student-dominated teaching is characterized by reduced teacher guidance and a high level of student autonomy in the learning process. It aligns with the Swedish teaching mode known as "independent work", which gained prominence in the late 1990s, criticized for its limited interaction between teachers and students (Eriksson, 2009; Carlgren, 2006).

Taken together, these items were used as reflective indicators of the three teaching practices and resonate relatively well with associated constructs.

Mental health complaints. In the grade 9 questionnaire, a total of 13 items were specifically designed to assess students' mental health. Eight of these items were adapted from the PSP (Psychosomatic Problems) scale developed by Hagquist (2008). These items aimed to gauge various aspects of mental health over the last six months and included questions like: "Have you experienced difficulties concentrating?", "Have you had trouble sleeping?", "Have you had headaches?", "Have you had stomachaches?", "Have you felt tense?", "Have you experienced a poor appetite?", "Have you felt sad?", and "Have you felt giddy?" Responses were provided on a scale from "Always" (1) to "Never" (5), with higher values indicating poorer mental health.

Additionally, five more items were included from the grade 9 questionnaire to comprehensively assess emotional well-being over the same time frame. These items inquired about experiences such as "Feeling irritated", "Feeling nervous", "Feeling down", "Having conflicts with peers", and "Withdrawing from peers". Similar to the first set of eight items, these questions also employed a reverse-coded response scale.

The initial eight items closely resemble those used in the HBSC international survey (Currie et al., 2009) to measure both somatic (headache, backache, stomachache, and dizziness) and psychological (feeling low, irritability and bad temper, nervousness and difficulties getting to sleep) mental health problems. The latter five items correspond to common indicators of emotional distress, such as depressed mood, a sense of hopelessness, feelings of failure, irritability, sleeplessness, difficulties concentrating and social withdrawal (Power, 2013). These indicators are consistent with established scales like the Youth Self Report depression scale (Achenbach, 1991) and Strengths and Difficulties Questionnaires (SDQ; Goodman, 1997), which are commonly employed to evaluate depressive or affective disorders in children and adolescents.

Giota and Gustafsson (2017) conducted an analysis of the underlying dimensions of these items and concluded that they measure two somewhat different yet overlapping dimensions of mental health (see also Dey et al., 2015). Building upon their findings, we utilized these items to assess two latent factors: *Emotional distress* and *Psychosomatic symptoms*.

Academic achievement. We assessed the students' academic performance by examining the school grades assigned by their teachers at the conclusion of grade 9, which marks the end of compulsory schooling in Sweden (typically at the age of 15–16 years).

In Sweden, the grading system is criterion-referenced, meaning that students receive grades based on specific criteria established for each subject, aligning with the national curriculum. These grades primarily result from ongoing classroom assessments, where teachers evaluate and grade students' performance. Upon the completion of compulsory schooling, students are assigned a final school grade, which is determined by summing the grades for their 16 best subjects from the final year.

Each subject is assessed using a 6-step scale, spanning from fail (F) to pass (E), and up to pass with special distinction (A). These grades are then converted into numerical values, ranging from 0 (F) to 20 (A). Consequently, the potential grade sum covers a continuous and equally spaced range, representing students' overall academic accomplishments, ranging from 0 to 320. These end-of-compulsory-school grades

play a crucial role in the selection process for the subsequent educational level when students apply for positions in upper secondary national education programs.

Socioeconomic status. We used information on the level of education achieved by either parent to assess students' socioeconomic status (SES), aligning with previous research (Gustafsson & Yang Hansen, 2018; Sirin, 2005). We categorized students into two groups: "low SES" and "high SES". In our categorization, low SES students were those with parents who had completed at most upper secondary education, corresponding to ISCED level 3, while high SES students where those from families where at least one parent held a tertiary (college/university) degree, corresponding to ISCED level 5–8.

This categorization allowed us to differentiate students based on their familial educational backgrounds. In our study, low SES implies that students come from homes with limited academic experience and fewer resources, while high SES indicates that students come from homes where academic experience is higher, and resources are more plentiful.

We made this choice of using parental education as SES indicator for two primary reasons. First, while other indicators like home possessions may offer valuable insights, they are not always be readily accessible or consistently reported (Wiberg & Rolfsman, 2023). Data availability prioritized indicators like parental education, reliably maintained by educational institutions or, as in our case, obtained from national registers. Secondly, parental educational attainment is an established measure with a well-documented association with educational outcomes, akin to factors like income (Sirin, 2005). Recognizing the multifaceted nature of SES and the potential for a more comprehensive operationalization, our approach, while not capturing all facets, remains a meaningful proxy for family and social background within the scope of our study.

Covariates. Two background characteristics served as covariates in the present study: Gender and Cognitive ability. Gender differences are evident both in academic outcomes, with girls typically outperforming boys (Voyer & Voyer, 2014), and in mental health, where girls frequently report higher rates of psychosomatic and depressive symptoms (Currie et al., 2008; Salk et al., 2017). Classroom dynamics further highlight gender differences (e.g., Meece et al., 2006; Mullola et al., 2012), with boys often having more influence over lesson content (Samuelsson & Samuelsson, 2015) and teacher-student interactions varying by gender (Liu et al., 2016; Tobia et al., 2019). These dynamics can shape how each gender responds to teaching practices, influencing their academic and mental health.

Cognitive ability, too, holds importance, being both associated negatively with self-rated mental health (Khandaker et al., 2018) and positively with achievement (Peng et al., 2019). Additionally, it has the potential to influence students' perceptions of academic demands (Giota & Gustafsson, 2017) and teachers' instructional strategies (Gest & Rodkin, 2011). Despite the potential influence of other variables on learning and mental health, our focus on these two is grounded in their foundational significance and, in accordance with parsimony principles, was deemed sufficient for our study.

Gender was coded as boy/girl (0/1), and the following is a description of the cognitive ability measure. Notably, the cognitive tests, and consequently, the measure of cognitive ability, were exclusively conducted in the sixth grade. Participating students underwent an aptitude test battery comprising four cognitive sub-tests. These sub-tests included two verbal assessments aimed at measuring vocabulary, particularly antonyms and synonyms, one spatial evaluation focused on assessing visualization skills, particularly mental folding ability, and one inductive test designed to gauge numerical reasoning ability, featuring items related to number sequences. These tests encompass aspects of both fluid and crystallized intelligence (as discussed in Giota & Gustafsson, 2017).

In this study, the results from these cognitive tests were aggregated into a total score for each student, which was subsequently standardized to generate a *z*-score. This *z*-score ranged from −3.26 to 2.75. The administration of these tests followed a strict protocol, with the classroom teacher responsible for distribution, in line with comprehensive

Table 1
Descriptive statistics for the observed variables.

	N	M	SD	Skewness	Kurtosis	% Missing
Teaching practices (Grade 9)						
Teacher talks most of the time	4529	3.37	0.80	−0.22	3.16	0.96
Having written homework tasks	4526	3.43	0.94	−0.28	2.73	0.96
Doing tests	4532	3.75	0.79	−0.21	2.91	0.90
Teacher and students discuss together	4528	3.25	0.89	−0.26	2.79	0.98
Working in groups	4532	3.08	0.74	−0.10	3.19	0.90
Being involved in planning instruction	4530	2.39	1.04	0.40	2.57	0.94
Independently seeking information	4534	3.63	0.92	−0.31	2.70	0.85
Planning and working with own work	4518	3.05	1.04	−0.06	2.56	1.20
Presenting own work or project	4529	3.13	0.89	0.01	2.96	0.96
Mental health complaints (Grade 9)						
Difficulties concentrating	4517	3.15	1.00	−0.11	2.57	1.22
Difficulties sleeping	4516	3.39	1.11	−0.29	2.35	1.25
Headache	4502	3.43	1.10	−0.33	2.35	1.55
Stomachache	4505	3.68	1.07	−0.53	2.56	1.59
Felt tense	4513	3.29	1.12	−0.17	2.24	1.31
Poor appetite	4507	3.95	1.06	−0.85	3.03	1.44
Felt sad	4512	3.42	1.09	−0.34	2.42	1.33
Felt giddy	4506	3.84	1.06	−0.66	2.66	1.47
Felt irritated	4517	2.93	0.94	0.12	2.73	1.22
Felt nervous	4513	3.19	1.00	−0.10	2.53	1.33
Felt down	4504	3.41	1.12	−0.31	2.33	1.51
Conflict with peers	4505	4.20	0.92	−1.08	3.78	1.49
Withdrawn from peers	4509	4.39	0.92	−1.60	5.18	1.40
Cognitive ability (Grade 6)[a]	7682	−2.24	1	−0.15	2.50	4.06
Academic achievement (Grade 9)	9280	218.44	59.5	−0.99	4.42	4.04[b]

Note. % Missing = internal missingness/nonresponse on item(s).
[a] *z*-standardized.
[b] in relation to the original sample.

written guidelines. Importantly, neither the students who completed the tests nor the teachers who administered them were privy to the test results. These results were exclusively used for research purposes as part of the broader ETF project. Table 1 presents descriptive statistics for the study variables.

3.3. Analytic approach

We adopted a two-step approach for our analysis, employing confirmatory factor analysis (CFA) and structural equation modeling (SEM). Initially, we established measurement models and subsequently estimated a structural model. The statistical analyses were conducted using Mplus 8 (Muthén & Muthén, 1998-2017).

In the first step, we constructed a measurement model for teaching practices, comprising three factors: *Teacher-centered teaching*, *Student-centered teaching*, and *Student-dominated teaching*. These factors were specified by their respective indicators, and covariance was allowed between them. Then, we estimated a measurement model for mental health complaints, consisting of two factors: *Emotional distress* and *Psychosomatic symptoms*. These factors were also specified by their respective indicators and included covariance between them. The configuration of the mental health measurement model followed the approach of Giota and Gustafsson (2017). Three items were permitted to load on both factors, specifically Difficulties sleeping, Felt tense, and Poor appetite, as they seemed to encompass both somatic and emotional distress aspects, justifying their representation on both dimensions of mental health (Giota & Gustafsson, 2017; see also Dey et al., 2015).

In addition, construct validity, covering convergent and discriminant aspects, was assessed using the average variance extracted (AVE) and the Fornell and Larcker (1981) criterion (Cheung et al., 2023). An AVE threshold of 0.5 or above indicate satisfactory convergent validity, while the square root of AVE exceeding the correlation between latent factors ensure discriminant validity. Moreover, considering the study's focus on exploring variations in associations between low and high SES students, we tested the measurement invariance of these models. This involved assessing three levels of invariance: configural, metric, and scalar (Putnick & Bornstein, 2016). These analyses addressed the equivalence of factor structures, factor loadings, and indicator intercepts across both groups.

In the second step, we estimated a structural equation model to predict mental health complaints and academic achievement based on teaching practices. In this model, we included Gender (boy/girl) and Cognitive ability as control variables for the outcomes. These control variables had directional paths to the observed variable *Academic achievement* and the latent factors *Emotional distress* and *Psychosomatic symptoms* (see Fig. S1 in the Supplementary Materials for a visualization). The model was estimated through multigroup analysis, using SES as a grouping variable. This allowed us to compare results for low and high SES students. Initially, we estimated a model with constrained structural paths, ensuring equality across both groups. Subsequently, a fully unconstrained model was estimated. Model fit of the constrained vs. unconstrained model was assessed using chi-square difference testing. Finally, we examined individual path coefficients that were statistically significant for both groups, using Wald tests, to formally test whether these coefficients significantly differed between groups.

To evaluate model fit, we considered fit indices such as Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR). Following conventional thresholds, CFI and TLI values should approach 0.95 or higher, and RMSEA and SRMR should be below 0.08 for model acceptability (Hu & Bentler, 1999). To address the nested data structure and account for clustering effects, we employed the "complex" option in Mplus (with school-id as the cluster variable), providing robust standard error estimates and unbiased test statistics. All models were estimated using the Full Information Maximum Likelihood (FIML) method (Enders, 2010). Table S1 in the Supplementary Materials presents the correlations between the study variables.

4. Results

4.1. Measurement models: teaching practices and mental health complaints

The measurement model for teaching practices demonstrated acceptable fit ($\chi^2 = 371.31$, df = 24, CFI = 0.94, TLI = 0.91, RMSEA = 0.06, SRMR = 0.04), with all standardized factor loadings statistically significant ($p < 0.001$). One item, "*The teacher talks most of the time during lessons,*" had a low factor loading but was considered theoretically reasonable to retain. Table 2 presents standardized loadings of the items for factors in the three-factor model constructed to measure relative frequencies of the three types of teaching practices.

The mental health complaints measurement model displayed adequate fit ($\chi^2 = 1662.03$, df = 61, CFI = 0.94, TLI = 0.93, RMSEA = 0.07, SRMR = 0.04). All standardized factor loadings were statistically significant ($p < 0.001$) and demonstrated reasonable loadings. Table 3 provides standardized loadings for items within the two-factor model measuring mental health complaints frequencies.

Table 4 presents validity test results. The AVE ranged from 0.29 to 0.43, indicating a shortfall below the 0.5 threshold, revealing limited convergent validity among the latent variables. However, AVE values on the diagonal exceeded the respective correlation values, signifying that each latent variable shares more variance with its indicators than with other latent variables, thus supporting the presence of discriminant validity in the latent factors.

Turning to the assessment of measurement invariance for these models, Table 5 presents results for the configural, metric, and scalar invariance models. These models had good overall fit, and no significant differences were observed in the measurement model for teaching practices.

Examining the measurement model for mental health complaints,

Table 2
Standardized factor loadings in the measurement model for teaching practices.

	Teacher-centered teaching			Student-centered teaching			Student-dominated teaching		
	λ	S.E.	σ	λ	S.E.	σ	λ	S.E.	σ
The teacher talks most of the time during lessons	0.21	0.02	0.95						
Having written homework tasks	0.88	0.05	0.23						
Doing tests	0.51	0.03	0.74						
Teacher and students discuss together				0.48	0.03	0.77			
Working in groups				0.48	0.02	0.77			
Being involved in planning instruction				0.65	0.02	0.59			
Independently seeking information							0.50	0.01	0.75
Planning and working with own work							0.66	0.01	0.56
Presenting own work or project							0.77	0.01	0.42

Note. All items loaded statistically significant ($p < 0.001$); λ = standardized factor loading; S.E. = standard error; σ = residual variance.
Reliability Teacher-centered teaching: α = 0.50, ω = 0.57, Student-centered teaching: α = 0.54, ω = 0.55; Student-dominated practices: α = 0.67, ω = 0.68.

Table 3
Standardized factor loadings in the measurement model for mental health complaints.

	Emotional distress		Psychosomatic symptoms		
	λ	S.E.	λ	S.E.	σ
Difficulties concentrating	0.65	0.01			0.39
Difficulties sleeping	0.30	0.03	0.36	0.03	0.40
Headache			0.73	0.01	0.53
Stomachache			0.70	0.01	0.49
Felt tense	0.41	0.03	0.36	0.03	0.54
Poor appetite	0.33	0.03	0.32	0.03	0.38
Felt sad	0.87	0.01			0.76
Felt giddy			0.74	0.01	0.55
Felt irritated	0.76	0.01			0.54
Felt nervous	0.64	0.01			0.37
Felt down	0.82	0.01			0.79
Conflicts with peers	0.52	0.01			0.25
Withdrawn from peers	0.50	0.01			0.24

Note. All items loaded statistically significant ($p < 0.001$).
λ = standardized factor loading; S.E. = standard error; σ = residual variance.
Reliability Emotional distress: α = 0.89, ω = 0.83; Psychosomatic symptoms: α = 0.84, ω = 0.75.

significant chi-square differences emerged between the scalar model and both the configural and metric models. While initially suggesting potential non-invariance, the sensitivity of chi-square to large sample sizes could result in significant differences even with minor variations (Cheung & Rensvold, 2002). Therefore, following established practices, we assessed differences in other fit indices between successive models (Putnick & Bornstein, 2016). Consistent with conventional criteria, the next level of invariance was not supported if the higher-level model decreased CFI by > 0.01 or increased RMSEA by > 0.015 (Chen, 2007; Cheung & Rensvold, 2002).

Subsequent analysis of scalar versus configural invariance yielded ΔCFI = 0.004 and ΔRMSEA = 0.005. Similarly, the comparison between scalar and metric invariance revealed differences of largely equivalent magnitude (Table 5). Together, these results indicate that the measurement models were indeed invariant across the two groups.

4.2. Structural model: predicting mental health complaints and academic achievements

The comparison between the constrained ($\chi^2 = 4353.39$, df = 575, $p < 0.001$, CFI = 0.88, TLI = 0.88, RMSEA = 0.04, SRMR = 0.07) and the unconstrained models ($\chi^2 = 3075.41$, df = 548, $p < 0.001$, CFI = 0.92, TLI = 0.92, RMSEA = 0.03, SRMR = 0.05) revealed a decrease in model fit when constraining structural paths across low and high SES students. The significant chi-square difference ($\Delta\chi^2 = 1277.98$, Δdf = 27, $p < 0.001$) further indicates divergent structural relationships between the two groups. These results highlight the importance of considering these differences in the interpretation of the structural model.

Table 6 presents standardized beta coefficients (β) and their corresponding standard errors (S.E.) for the associations between teaching practices and student outcomes. The results are presented for the entire sample and are further stratified by SES. In addition to *p*-values, confidence intervals (CI) are provided, for precision of estimates. Effect sizes, indicating the magnitude of association, contribute to the interpretation of real-world implications. We define effect sizes as small (β = 0.1), moderate (β = 0.3), and large (β ≥ 0.5) following established conventions. We present the outcomes for each teaching practice factor and their associations with *Emotional distress*, *Psychosomatic symptoms*, and *Academic achievement*.

4.3. Teacher-centered teaching

Emotional distress. In the full sample, *Teacher-centered teaching* exhibits a non-significant, small negative association with *Emotional distress* (β = −0.002, 95% CI [−0.06, 0.02], $p = 0.355$). This pattern persists when stratified by SES, with a slightly more negative yet non-significant association for low SES students (β = −0.06, 95% CI [−0.14, 0.03], $p = 0.147$) and a non-significant positive association for high SES students (β = 0.02, 95% CI [−0.01, 0.06], $p = 0.521$).

Psychosomatic symptoms. *Teacher-centered teaching* shows a non-significant, small positive association with psychosomatic symptoms in the full sample (β = 0.02, 95% CI [−0.03, 0.07], $p = 0.562$). This pattern persists when stratified by SES, with a slightly more negative yet

Table 4
AVE and correlation values among latent factors.

	AVE	1	2	3	4	5
1. Teacher-centered teaching	0.34	(0.59)				
2. Student-centered teaching	0.29	−0.01	(0.54)			
3. Student-dominated teaching	0.43	0.14[a]	0.74[a]	(0.65)		
4. Emotional distress	0.36	0.09[a]	−0.16[a]	−0.01	(0.60)	
5. Psychosomatic symptoms	0.35	0.14[a]	−0.11[a]	0.04[+]	0.76[a]	(0.59)

Note. AVE = Average variance extracted; Square-root of AVE on diagonal.
[a] p<0.001, +p<0.10.

Table 5
Tests of measurement invariance of the measurement models across SES groups.

	χ^2	*df*	*p*	CFI	RMSEA	SRMR
Teaching practices						
Configural	416.51	48	<0.001	0.938	0.059	0.041
Metric	425.91	54	<0.001	0.937	0.056	0.042
Scalar	434.20	60	<0.001	0.937	0.053	0.043
Metric vs. Configural	9.40	6	0.1526	–	–	–
Scalar vs. Configural	17.69	12	0.1256	–	–	–
Scalar vs. Metric	8.29	6	0.2176	–	–	–
Mental health complaints						
Configural	1675.88	122	<0.001	0.942	0.076	0.038
Metric	1688.34	136	<0.001	0.942	0.072	0.039
Scalar	1791.88	147	<0.001	0.938	0.071	0.040
Metric vs. Configural	12.46	14	0.5696	–	–	–
Scalar vs. Configural	116.01	25	<0.001	–	–	–
Scalar vs. Metric	103.55	11	<0.001	–	–	–

Table 6
Structural path coefficients for teaching practices predicting student mental health complaints and academic achievements.

	Full sample (unconditional model)				Low SES students (n = 1949)				High SES students (n = 2368)			
	β	S.E.	95% CI	*p*	β	S.E.	95% CI	*p*	β	S.E.	95% CI	*p*
Emotional distress												
← Teacher-centered teaching	−0.02	0.02	−0.06, 0.02	0.355	−0.06	0.04	−0.14, 0.03	0.147	0.02	0.03	−0.01, 0.06	0.521
← Student-centered teaching	−0.30	0.05	−0.40, −0.20	<0.001	−0.33	0.07	−0.47, −0.19	<0.001	−0.26	0.06	−0.37, −0.16	<0.001
← Student-dominated teaching	0.18	0.04	0.11, 0.25	<0.001	0.18	0.07	0.04, 0.32	0.009	0.18	0.06	0.07, 0.29	0.001
Psychosomatic symptoms												
← Teacher-centered teaching	0.02	0.03	−0.03, 0.07	0.562	−0.03	0.04	−0.11, 0.05	0.530	0.06	0.03	−0.00, 0.12	0.070
← Student-centered teaching	−0.24	0.05	−0.34, −0.14	<0.001	−0.32	0.08	−0.50, −0.14	<0.001	−0.16	0.07	−0.30, −0.03	0.017
← Student-dominated teaching	0.18	0.05	0.10, 0.26	<0.001	0.24	0.08	0.08, 0.40	0.002	0.12	0.06	−0.01, 0.25	0.060
Academic achievement												
← Teacher-centered teaching	0.14	0.02	0.10, 0.18	<0.001	0.18	0.04	0.09, 0.27	<0.001	0.08	0.03	0.02, 0.14	0.005
← Student-centered teaching	0.16	0.05	0.07, 0.26	0.001	0.12	0.06	0.01, 0.23	0.025	0.20	0.08	0.05, 0.34	0.010
← Student-dominated teaching	−0.01	0.05	−0.11, 0.09	0.944	0.01	0.06	−0.11, 0.13	0.984	−0.02	0.07	−0.15, 0.10	0.839

Note. Standardized coefficients for the full sample and multigroup models, with gender and cognitive ability included as controls.

non-significant association for low SES students (β = −0.03, 95% CI [−0.11, 0.05], p = 0.530). Conversely, among high SES students, a positive association is observed, but with a lack of convincing statistical evidence to support its significance (β = 0.06, 95%, CI [−0.00, 0.12], p = 0.070).

Academic achievement. *Teacher-centered teaching* reveals a significant positive association with *Academic achievement* in the full sample (β = 0.14, 95% CI [0.10, 0.18], $p < 0.001$) and among both low (β = 0.18, 95% CI [0.09, 0.27], $p < 0.001$) and high SES students (β = 0.08, 95% CI [0.02, 0.14], p = 0.005). The effect sizes, coupled with narrow confidence intervals, suggest a meaningful and precise association with *Academic achievement*. A Wald test of parameter constraints revealed a difference between the two groups: $\chi^2(1) = 9.52$, p = 0.002. Hence, *Teacher-centered teaching* had a more substantial effect on *Academic achievement* for students with less-educated parents compared to those with highly educated counterparts.

4.4. Student-centered teaching

Emotional distress. Moving on to the factor *Student-centered teaching*, significant negative associations are observed in the full sample (β = −0.30, 95% CI [−0.40, −0.20], $p < 0.001$) and among both low (β = −0.33, 95% CI [−0.47, −0.19], $p < 0.001$) and high SES students (β = −0.26, 95% CI [−0.37, −0.16], $p < 0.001$). The effect sizes, coupled with narrow confidence intervals, suggest a meaningful and precise association with less frequent, or lower levels of, *Emotional distress*.

Psychosomatic symptoms. Significant negative associations persist in the full sample (β = −0.24, 95% CI [−0.34, −0.14], $p < 0.001$) and among both low (β = −0.32, 95% CI [−0.50, −0.14], $p < 0.001$) and high SES students (β = −0.16, 95% CI [−0.30, −0.03], p = 0.017). The effect sizes, together with relatively narrow confidence intervals, indicate a meaningful and precise association with less frequent, or lower levels of, *Psychosomatic symptoms*. Notably, no significant differences were found between low and high SES students in the path coefficients for either *Emotional distress* or *Psychosomatic symptoms*. The consistent negative association across SES groups suggests that *Student-centered teaching* is robustly linked to lower mental health complaints, emphasizing its potential role in promoting student well-being.

Academic achievement. Concluding our exploration of *Student-centered teaching*, significant positive associations are observed in the full sample (β = 0.16, 95% CI [0.07, 0.26], p = 0.001) and among both low (β = 0.12, 95% CI [0.01, 0.23], p = 0.025) and high SES students (β = 0.20, 95% CI [0.05, 0.34], p = 0.010). The effect sizes, together with a relatively narrow confidence intervals, suggest a meaningful and precise association with higher *Academic achievement*.

4.5. Student-dominated teaching

Emotional distress. Shifting our focus to *Student-dominated teaching*, positive and significant associations are observed in the full sample (β = 0.18, 95% CI [0.11, 0.25], $p < 0.001$). This positive association was observed for both low SES (β = 0.18, 95% CI [0.04, 0.32], p = 0.009) and high SES students (β = 0.18, 95% CI [0.07, 0.29], p = 0.001) indicating a moderate association with more frequent or higher levels of *Emotional distress*. The confidence intervals, while not extremely narrow, still lend support to the significance of the associations.

Psychosomatic symptoms. Positive and significant associations are observed in the full sample (β = 0.18, 95% CI [0.10, 0.26], $p < 0.001$) and among low SES students (β = 0.24, 95% CI [0.08, 0.40], p = 0.002), while the association is positive but lacks robust statistical evidence for its support among high SES students (β = 0.12, 95% CI [−0.01, 0.25], p = 0.060). The effect sizes and confidence intervals suggest a moderate association with more frequent, or higher levels of, *Psychosomatic symptoms*, but caution is warranted, especially for high SES students.

Academic achievement. Concluding our examination of *Student-dominated teaching*, non-significant associations are observed in the full sample (β = −0.01, 95% CI [−0.11, 0.09], p = 0.944) and among both low (β = 0.01, 95% CI [−0.11, 0.13], p = 0.984) and high SES students (β = −0.02, 95% CI [−0.15, 0.10], p = 0.839). This indicates a lack of a statistically meaningful relationship between *Student-dominated teaching* and *Academic achievement*. Thus, the types of teaching practices captured by this factor are not only negatively associated with student mental health but also appear to have no bearing on school grades.

5. Discussion

In this study, we investigated links among teaching practices in Swedish schools, students' academic achievements, and their mental health. The results uncovered varying associations between specific ways of organizing teaching, students' achievement and, notably, their mental health complaints. Further analysis of variations in these associations based on students' social background yielded additional insights.

Regarding teacher-centered practices, our results indicate a positive correlation between these practices and school grades for both low and high SES students. This finding is consistent with established research on the effectiveness of teacher-centered methodologies (Algan et al., 2013; Beitenbeck, 2014; Kirschner et al., 2006; Magliaro et al., 2005; Stockard et al., 2018). The historical efficacy of these practices, particularly in domains such as content delivery and progress evaluation, remains evident. Importantly, the more guided instructional mode inherent in this approach significantly contributes to students' success (Stockard

et al., 2018), highlighting its continued relevance. Additionally, tests inform students about meeting learning criteria and guide their efforts toward specific tasks, preventing divergence (Hattie & Timperley, 2007). However, these practices do not appear to be universally equally effective for all student groups.

One notably distinctive association, and one of only two significant differences between low and high SES students, was observed in the relationship between *Teacher-centered teaching* and *Academic achievement*, with this association being more pronounced for students with less-educated parents compared to those with highly educated parents. This result is consistent with previous research indicating that "less-skilled learners", or, in our case, students from homes with fewer resources or less cultural capital, tend to derive greater benefits from highly guided instruction. In contrast, "more-skilled learners", or students from well-resourced homes viewed as more self-regulated learners, may thrive in educational settings characterized by less-guided instruction (Andersen & Andersen, 2017; Kirschner et al., 2006).

One key takeaway based on this result is the importance of teacher guidance, particularly for students in areas with low SES families, who may have limited academic support at home. This underlines the significance of teacher instruction and, when considering the specific items that comprised this factor in our model, also the use of 'traditional' assessment strategies to track students' progress in addressing potential academic gaps associated with varying levels of SES. This, in turn, underscores the role of teachers in providing essential guidance for students facing potential challenges, aligning with the compensatory aim of the school. To achieve this, it is imperative to establish policies and conducive conditions in schools, enabling teachers to fulfill their roles and concentrate on the core mission of teaching.

Despite the positive correlation we observed between *Teacher-centered teaching* and *Academic achievement*, our conceptualization of teacher-centered practices highlighted a potential drawback, raising concerns about potential declines in student engagement, autonomy, and motivation to learn (Loughlin & Lindberg-Sand, 2023; Rocca, 2010). Additionally, the inclusion of extensive formal testing, expected to elevate stress levels among students (Giota & Gustafsson, 2017; Låftman et al., 2013; Östberg, 2015), led us to expect an association with increased mental health complaints. Contrary to our expectations, our study found no convincing links between teacher-centered practices and student mental health complaints, neither in terms of emotional distress nor psychosomatic symptoms.

Moving on to student-centered practices, our findings indicate that higher levels of these practices are correlated with lower levels of emotional distress and psychosomatic symptoms, along with higher grades, for both low and high SES students. These results also align with previous research highlighting the positive impact of student-centered approaches on both student well-being and academic performance (Bernard et al., 2019; Mager & Nowak, 2012; Wilder, 2015). Activities such as group work and collaborative discussions with teachers, central to student-centered teaching, have been appreciated by students (Cairns & Areepattamannil, 2019; Korbel & Paulus, 2018). Moreover, elements of teacher support for autonomy and student influence on their own education, as indicated by items like *'Being involved in planning instruction'*, have been linked to decreases in anxiety and depression (Yu et al., 2016). Additionally, engaging students with instruction provides opportunities to enhance their knowledge and understanding of concepts (Niemiec & Ryan, 2009). The item *'Teacher and students discuss together'* may reflect situations of formative assessment, where teachers provide feedback and jointly discuss the students' learning process (Giota & Emanuelsson, 2018). Taken together, the practices reflected by the factor *Student-centered teaching* are likely to adequately satisfy the autonomy, relatedness, and competence needs of adolescent students, thereby positively contributing to both their mental health and academic outcomes.

Extending on these results, these practices are consistent with a 'whole child' approach in education (Darling-Hammond & Cook-Harvey, 2018), emphasizing the holistic development of students beyond their academic accomplishments. Such an approach recognizes the interconnected nature of academic, social, and emotional well-being. Student-centered teaching, with its focus on collaborative learning, autonomy support, and meaningful involvement, aligns with the broader goal of nurturing students comprehensively, fostering not only academic success but also overall well-being.

However, an excessive emphasis on student-centeredness, marked by a (too) high imposition of autonomy on students and minimal teacher guidance, has been linked to negative effects on learning (Pokropek et al., 2018; Teig et al., 2018) and other desirable developmental outcomes (e.g., Stipek & Byler, 2004). In our study, a high level of student-centeredness was represented by the factor *Student-dominated teaching*. The indicators for *Student-dominated teaching* reflected practices characterized by limited student-teacher (or student-student) interaction, presumably resulting in minimal teacher instruction and fewer opportunities for peer-learning. In contrast, the other factors (*Teacher-centered* and *Student-centered teaching*) had indicators that arguably captured aspects of full and partial teacher instruction (cf. Kirschner et al., 2006). Considering the crucial role of instructional guidance provided by teachers in the learning process (Lazonder & Harmsen, 2016), the lack of a significant association between *Student-dominated teaching* and *Academic achievement* might be viewed as less surprising.

Conversely, higher levels of *Student-dominated teaching* correlated with higher levels of *Emotional distress* for high SES students and higher levels of both *Emotional distress* and *Psychosomatic symptoms* for low SES students. These results confirm that teaching practices in Swedish schools, especially the shift towards more individualistic approaches since the late 1990s (Skolverket, 2009), such as self-directed independent work, were linked to the increasing levels of psychosomatic problems reported among Swedish youth (PHAS, 2018).

The surge in individualization and student-centeredness implemented in practice, which became predominant in Swedish comprehensive school from 1990s onwards, diverged from the initial concept as outlined in the Swedish national curricula (Carlgren et al., 2006; Eriksson, 2009). The original concept emphasized adapting instruction to cater to the individual needs, abilities, and interests of each student, along with considering the collective needs of the entire student group (Giota & Emanuelsson, 2018). However, achieving true individualization requires substantial resources and pedagogical awareness (Creemers et al., 2014). Instead, as teachers sought to balance curricular demands with real-world conditions, students were given greater responsibility for planning, conducting, and evaluating significant portions of their schoolwork independently, often with limited teacher guidance (Eriksson, 2009; Giota & Emanuelsson, 2018; Skolverket, 2009). This resulted in the Student-dominated ('independent/individual work') teaching practices (Carlgren et al., 2006; Eriksson, 2009), reflecting a trivialized form of individualization (Giota & Emanuelsson, 2018).

Additionally, the study found that *Student-dominated teaching* had negative links with *both* dimensions of mental health for low SES students, while only showing such an association with *one* dimension for high SES students (marking the second and sole other significant difference between low and high SES students). This suggests that these practices were more detrimentally linked to the mental health of low SES students than to that of high SES students. Consequently, it implies that the adoption of increasingly prevalent autonomous learning approaches, emphasizing self-regulation and gaining traction after the 2000s (Carlgren et al., 2006), might have intensified the vulnerability of already resource-poor students, as indicated in earlier research (Skolverket, 2009).

5.1. Implications

On a theoretical level, our study contributes to broadening the

perspective on student-centeredness by discerning between beneficial practices and potentially detrimental approaches. This understanding is vital for shaping theoretical frameworks exploring the interplay of student-centeredness with both academic and mental health outcomes. Our findings underscore the need to strike a balance between student autonomy–where students independently direct and regulate substantial aspects of their learning–and the need for teacher guidance. While student-centered approaches hold promise for fostering autonomy and relatedness, our study highlights that an overemphasis on self-directed teaching, without adequate instructional support, may not only jeopardize academic achievements but also contribute to mental health concerns.

On a practical level, educators and policymakers should implement measures supporting educational individualization. This requires aligning curriculum goals with practical implementation, prioritizing resource enhancements, and pedagogical awareness among decision-makers. The adoption of resources and strategies facilitating personalized instruction while maintaining teacher-student interaction is crucial. Creating an environment for tailored learning experiences without compromising the supportive teacher-student connection is essential. Moving forward, curriculum designers ought to be cognizant of how curriculum content may impact student mental health, advocating for an approach that value student well-being alongside academic achievement.

5.2. Limitations and future directions

The results should be considered alongside certain limitations. While the selected items aimed to capture distinct teaching practices, some may not perfectly align with the intended constructs. Despite measurement challenges, associations between teaching practices and *Academic achievement* were consistent with prior research (Algan et al., 2013; Bietenbeck, 2014; Seidel & Shavelson, 2007; Wilder, 2015), thereby strengthening the model's validity. However, measurement limitations may affect interpretation and comparability, emphasizing the need for refined approaches in future research.

While the original sample's representativeness was strong in grade 3, concerns arise regarding its continued representativeness in grade 9 due to reduced response rates. To enhance generalizability, future studies should explore associations in diverse populations or contexts.

The temporal limitation to 2011–2012 prompts reflection on changes in the Swedish comprehensive school system, notably the implementation of a new curriculum and heightened use of digital learning resources (Högberg et al., 2021; Rönn, 2022; Utterberg et al., 2019). These changes, such as the shift to grade 6 grading rather than grade 8, have introduced more challenging learning objectives, imposing greater demands on individual students. Consequently, these changes might have influenced the teaching and learning environment, potentially affecting the observed associations.

The reliance on students' self-reports for assessing both teaching practices and mental health has limitations, including shared method variance. While students' self-reports provide adequate measures of their mental health, future studies could enhance methodological rigor by incorporating additional perspectives such as teacher reports (cf. Hidalgo-Cabrillana & Lopez-Mayan, 2018) or employing alternative methods like classroom observations. Additionally, considering diverse dimensions of mental health, such as anxiety and stress, could provide more comprehensive insights into the relationship between teaching practices and student well-being. By adopting a multifaceted approach to data collection and analysis, researcher can overcome the inherent limitations of any single method and deepen our understanding of the mechanisms underlying the observed associations.

Exploring moderating or mediating analyses presents a promising avenue for further investigation. While our study examined inequalities by social background, other student characteristics (e.g., age/schoolyear and motivation/achievement goal orientation) likely shape these associations. Future studies should consider more nuanced differentiation within the student population and incorporate additional socioeconomic components to better understand disparities in education. Moreover, considering that our study generalized teaching practices across subjects, it would be valuable to examine differences between subjects and students.

Lastly, the proposed mechanisms through which the links may be mediated were not empirically assessed due to data constraints. Future researchers are encouraged to empirically test the extent to which students' sense of autonomy, competence, and relatedness (or other potential mechanisms) mediate the links between teaching practices and students' mental health (or achievement-related outcomes) to refine the insights gained in this study.

6. Conclusions

The results of this study affirm the advantages of both teacher- and student-centered teaching practices in terms of academic achievement, as well as the detriment of leaving students to 'discover the world' on their own without adequate teacher guidance. The findings provide initial evidence that the way students are taught in school may also have a bearing on their mental health. They also indicate that addressing social inequalities in education and mental health among adolescents may be partially achieved through greater pedagogical awareness of the differential impacts of teaching practices in schools. Overall, this study marks an important step toward a more comprehensive understanding of the inter-relationships in the school environment-student achievement-mental health triad.

CRediT authorship contribution statement

Cristian Bortes: Writing – review & editing, Writing – original draft, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization. **Joanna Giota:** Writing – review & editing, Writing – original draft.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.learninstruc.2024.101937.

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