



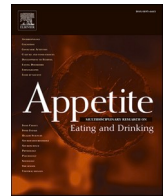
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“As long as it tastes good”: Students’ perceptions of climate-friendly school meals in a mixed-methods study

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ABSTRACT

Shifting toward sustainable diets is key to reducing the environmental impact of food systems. In school meals, this often involves meat reduction through strategies such as all-vegetarian days and lower-carbon recipe reformulation. Yet students' perceptions of such concrete menu changes have received little attention. This convergent mixed-methods study examined students' perceptions of climate-friendly school meals and their interpretations of meat reduction. Quantitative survey data from 1268 students across six Swedish schools were analyzed using multiple regression, alongside qualitative data from student discussions analyzed using reflexive thematic analysis. Both quantitative and qualitative findings suggested that lower-carbon recipe reformulation was more acceptable to students than vegetarian-only days. Quantitative analysis showed that more positive attitudes toward climate-friendly school meals were associated with perceiving climate considerations as important in food choice, more frequent selection of vegetarian meals at school, and being female. Students also showed clear awareness of the relative carbon footprint of red meat and plant-based foods across support levels. Qualitative findings, however, highlighted that the acceptability of climate-friendly meals depended strongly on perceived taste and satiety. Meat was positioned as a normative component of a meal, while acceptance of vegetarian meals was more conditional on familiarity and palatability. These findings corroborate earlier research showing that taste, familiarity, and meal norms shape acceptance of meat reduction in school meals more strongly than sustainability concerns alone. They also indicate that lower-carbon recipe reformulation may complement vegetarian-only days as a practical strategy for supporting acceptance and intake of climate-friendly school meals.

1. Introduction

Food systems are a major contributor to climate change, accounting for approximately one-third of global greenhouse gas (GHG) emissions (Crippa et al., 2021). Diets high in animal-based foods, particularly red meat and dairy, are associated with the largest carbon footprints, whereas plant-based foods generate substantially lower emissions (Poore & Nemecek, 2018). Shifting food consumption towards more plant-based options is therefore widely recognized as a key strategy for reducing dietary climate impact, while also aligning with nutritional recommendations and offering potential public health benefits, particularly in high-income countries (Bui et al., 2024; Clark et al., 2020; Rockström et al., 2025; Springmann, Clark, et al., 2018; Springmann, Wiebe, et al., 2018; Willett et al., 2019).

School meals represent an important setting for facilitating such dietary shifts. Globally, approximately one-fourth of students in primary and secondary schools receive school meals; in high-income countries, almost half receive a meal, making school meals a substantial and regular component of their food intake (Guio, 2023). Beyond nutritional provision, school meals provide a context for repeated exposure and social interaction that may influence food preferences, eating habits, and meal experiences (Chen et al., 2026).

Measures to increase the share of plant-based food in school meals have been introduced at the local or national level in several countries. One common strategy is the implementation of all-vegetarian days (Chang et al., 2023; de Boer et al., 2017; Lombardini & Lankoski, 2013).

An alternative approach is to modify recipes to reduce the share of high-emission ingredients. Intervention studies indicate that such

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reformulations can maintain intake and sensory satisfaction while achieving nutritionally adequate, cost-neutral meals and reducing greenhouse gas emissions by 20–40% (André et al., 2024; Elinder et al., 2020; Eustachio Colombo et al., 2020, 2021). However, these studies have mainly assessed acceptance through intake, plate waste, and sensory ratings, providing limited insight into students' own perceptions and interpretations of increased plant-based provision.

Existing research suggests that children and adolescents often have a limited understanding of sustainable eating and rarely identify sustainability as a primary driver of food choice (Lanham & van der Pols, 2025; Mesch et al., 2026). Instead, preferences are more strongly shaped by taste, familiarity, and social context than by environmental considerations (Eustachio Colombo et al., 2021; Lanham & van der Pols, 2025; Pater et al., 2022). Resistance to vegetarian school meals appears to be driven less by rejection of plant-based foods per se and more by concerns related to taste, familiarity, and a perceived restriction of choice (Frödén, 2021). Studies among adults further indicate that framing and labelling influence uptake, with explicitly “vegetarian” labels sometimes reducing selection compared to more neutral descriptions (Hielkema & Lund, 2022; Krpan & Houtsma, 2020).

Taken together, this literature highlights an important gap in understanding. While climate-friendly school meal interventions have often been evaluated in terms of consumption, environmental performance, nutritional quality, and satisfaction, less is known about how students themselves interpret different forms of meat reduction and how these meanings shape acceptance. Students' perspectives on the distinction between more overt vegetarian provision and subtler recipe reformulation remain limited. Understanding how students interpret and respond to these forms of change is important for their acceptability and longer-term feasibility in school meal settings. In this study, the term “climate-friendly” refers to meals designed to reduce greenhouse gas emissions (i.e., low-carbon meals).

This study extends existing research by examining not only whether students support climate-friendly school meals, but also how they interpret meat reduction in relation to taste, familiarity, and the social meaning of meals. In doing so, it provides insight into the conditions under which lower-carbon meal changes are more or less likely to be acceptable to students in everyday school eating.

The Swedish context is relevant because sustainability is already embedded in public meal planning, while school meal services must also balance environmental goals with nutritional adequacy, food waste, costs, and student acceptance. In 2021, 36% of Swedish municipalities had climate targets for school meals, and 61% always served a vegetarian option (Swedish Food Agency, 2025a). Previous research in Swedish school catering has shown that menu planning for sustainable development can involve goal conflicts between vegetarian provision, meal acceptance, and food waste (Sundin et al., 2023). Current Swedish public-meal discussions also highlight recurring concerns about climate-smart meals, including whether they are sufficiently filling, nutritionally adequate, acceptable to children, and whether climate-smart eating necessarily implies vegetarian provision (Eneroth & Rööf, 2026). This makes Swedish school meals a useful setting for examining how students interpret lower-carbon meal changes in relation to everyday meal expectations.

The present study addresses this gap within Sweden's universal school meal system, in which nutritious lunches are provided free of charge to all students. National guidelines specify that these meals should provide approximately one-third of daily energy needs (Swedish Food Agency, 2025b). Using a convergent mixed-methods design, this study combines quantitative and qualitative data to examine students' attitudes towards climate-friendly school meals and to explore how they perceive meat reduction in relation to taste, familiarity, and social influences. In doing so, it provides insight into how lower-carbon school meals can be designed to resonate with students' everyday eating practices.

2. Methods

This convergent mixed-methods study was conducted in six public schools within a Swedish school meal intervention context. It included students in grades 4–9, approximately 10–15 years of age, and combined survey data from 1331 students with four qualitative sessions involving 20 students. Quantitative and qualitative data were collected separately, analyzed independently, and integrated during interpretation to capture both overall attitudinal patterns and students' own accounts of how they understood and responded to climate-friendly school meals.

2.1. Study design and setting

This study was conducted in collaboration with Lund Municipality in southern Sweden, within the context of an ongoing school meal intervention previously described in detail (André et al., 2024). In this study, meals were prepared and served as part of regular school operations, meaning that the intervention was embedded in a setting that the students were accustomed to. The school meal is served as a self-service buffet, free of charge for all students. Each day, pupils choose between two main dishes, one of which is always vegetarian, and one is meat, fish, or chicken, accompanied by a salad buffet, bread, and milk. Six public schools participated, with two schools allocated to each of three conditions: implementation of a new low-carbon menu reducing GHG emissions by 20%; the same menu combined with informational materials; or continuation of the standard menu; see descriptives in Table 1. The low-carbon menu was achieved through a combination of recipe reformulation to reduce the share of high-emission ingredients and a slight increase in the number of all-vegetarian menus, from 1–2 days to 1–3 days per week. The informational materials consisted of a 3-min animated video, watched in class by all students in grades 4–9 at the start of the intervention, and posters displayed in the school restaurant. The video explained how food production contributes to climate change and that the school would reduce the menu's overall carbon footprint by reducing the share of high-emission foods, such as beef and other meat. The posters reinforced the same message using stills from the video.

The present study uses a convergent mixed-methods design (Creswell, 2014; Fetters, 2020) to examine both broad patterns and contextual meanings in students' perceptions of climate-friendly school meals. Survey data captured variation in attitudes and support across a large sample of students. At the same time, qualitative sessions provided deeper insights into how students interpreted menu changes in relation to taste, satiety, familiarity, and meal norms. Quantitative and qualitative data were collected during the fall semester of 2021. The survey was conducted before the intervention, whereas the qualitative sessions were conducted after the intervention in the two schools that received the low-carbon menu, one of which also received informational materials. Data were analyzed separately and integrated during interpretation to examine students' perceptions of climate-friendly school meals.

2.2. Quantitative component – survey

2.2.1. Quantitative survey

All students in grades 4–9 at participating schools were invited to complete a digital survey during scheduled classroom mentor time. The survey was conducted prior to the intervention using Qualtrics®. Participation was voluntary and anonymous; no incentives were provided, and no active refusals were recorded. Of 2118 enrolled students, 1331 completed the survey (63% response rate). Girls and boys were equally represented, and students in grades 7–9 were slightly over-represented compared with those in grades 4–6 (55% vs. 45%). Of the respondents, 1268 provided complete data and were included in the regression analyses. No exclusion criteria were applied beyond absence on the day of data collection.

Table 1
Descriptive characteristics of participating schools in Lund municipality.

School	Group	Data collection	Grades	Urban/rural	Students, grades 0–9	Students with foreign background (%)	Parents with post-secondary education (%)
Genarps skola	control	Survey	4–9	Rural	303	21	69
Tunaskolan	control	Survey	0–9	Urban	694	27	92
Hubertusgården	menu	Survey	0–6	Urban	209	32	80
Nyvångskolan	menu	Survey + Qual	0–9	Rural	857	17	78
Gunnesboskolan	menu + info	Survey + Qual	0–9	Urban	636	30	78
Prästängsskolan	menu + info	Survey	4–6	Rural	164	9	94

Note. The gender distribution was approximately equal across all schools. Grades 0–9 are the full range of grades in the mandatory Swedish school system, where 0 is a preparatory grade.

2.2.2. Quantitative data analysis

The primary outcome was an attitude index reflecting students' attitudes toward climate-friendly school meals. The index was constructed by summing responses to two Likert-type items assessing support for (1) changing school meal recipes to contain less meat and (2) increasing the number of all-vegetarian days. Each item was scored from 0 to 4, giving an index range of 0–8, with higher scores indicating more supportive attitudes. This combined measure was used to capture students' overall attitudes toward climate-friendly school meals across the two approaches. For descriptive visualization only, the index was divided into three score categories: negative (0–2), neutral (3–5), and positive (6–8). Regression analyses used the continuous index.

Differences in acceptance between low-carbon recipe reformulation and all-vegetarian days were examined using a paired *t*-test comparing the two attitude items. Separate item-level regression models were also estimated for support for low-carbon recipe reformulation and support for all-vegetarian days to examine whether associations differed between the two meat-reduction strategies.

Associations between attitudes toward climate-friendly school meals and individual-, school-, home-, and peer-level food environments were examined using multivariable linear regression. Model specification was informed by prior research linking meat consumption, environmental concern, and gender differences to sustainability-related food attitudes. Independent variables included sex, grade, frequency of red meat and vegetarian food consumption at home and at school, perceived peer food consumption, perceived importance of climate in personal and family food choices, and perceived climate impact of red meat and vegetarian foods. The survey instrument is provided in [Supplementary Material 1](#).

Sex was included as a categorical variable and grade as a continuous variable, consistent with recommendations to incorporate sex as both a biological and social variable in appetite research (Geary et al., 2025). Potential effect modification by sex and grade was explored; as no substantively different patterns were observed, pooled results are presented. Standardized regression coefficients (β) were calculated to facilitate comparison of effect sizes across variables. Statistical analyses were performed using Stata version 18.0, and visualizations were produced in R/RStudio.

2.3. Qualitative component

2.3.1. Participants and recruitment

Four qualitative sessions were conducted with students. Three sessions were focus groups, while one session included only one student due to participant absence and was therefore conducted as an individual interview. The interview followed the same semi-structured guide as the focus groups and generated rich, relevant data on students' perceptions of climate-friendly school meals. Therefore, the interview was retained in the analysis. The interview data were analyzed along with focus group data using reflexive thematic analysis, while acknowledging that the interactional dynamics differed from the group discussions. The

qualitative sessions were conducted in two schools following the meal intervention: two groups with students in grades 4–6 and one group and one interview with students in grades 7–9. A total of 20 students participated. Group sizes ranged from an individual interview to eight participants.

Students were randomly selected from class lists using a random number generator. A table identifying the selected classes and students was prepared and sent to school principals, together with written instructions describing the selection procedure. If a selected student was considered unable to participate by their teacher, the next student on the randomized list was invited instead. Reasons for replacement included behavioral or pedagogical considerations that could affect the student's ability to take part in the discussion. The researchers did not take part in these decisions.

Ten students per planned focus group were invited to participate. Invitation letters and consent forms were sent to legal guardians by email and post. Students were eligible to participate if written parental consent was returned, and the student provided verbal assent at the start of the discussion.

Reporting of the qualitative component was guided by the Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist. A complete checklist is provided in [Supplementary Material 2](#).

2.3.2. Qualitative data collection

The focus group discussions and one interview were conducted in quiet, private rooms arranged by school principals. Sessions took place around a large round table to facilitate discussion and lasted between 35 and 55 min. Discussions were audio-recorded.

A member of the research team moderated the discussions in Swedish using a semi-structured guide (provided in [Supplementary Material 3](#)) to explore experiences with school meals, perceptions of climate-friendly menu changes, and views on meat-reduction strategies. Two additional team members were present to take notes and, where appropriate, ask clarifying questions.

2.3.3. Qualitative analysis

Audio recordings were transcribed verbatim in Swedish using Sonix software. Transcripts were reviewed for accuracy and translated into English by the research team. Data were analyzed using reflexive thematic analysis, understood as an interpretive and situated approach in which themes are developed through researchers' active engagement with the data rather than discovered as pre-existing categories (Braun & Clarke, 2006).

The first two authors read the transcripts multiple times to achieve familiarity. The second author (RF) conducted the transcriptions and initial coding, after which the first author (MH), in collaboration with the co-author (EA), further developed and refined the coding and candidate themes. Coding was treated as an interpretive and flexible process rather than as a procedure for producing inter-coder reliability. Candidate themes were discussed among the authors to refine their

central organizing concepts and ensure that they captured patterned meanings across the dataset rather than simply summarizing interview questions or topic areas. Differences related to age group and school context were actively explored as meaningful dimensions of the data.

The analysis was conducted with attention to the researchers' positioning within the broader OPTIMAT project, which aimed to develop and evaluate climate-friendly school meals. This positioning created a potential risk of interpreting students' accounts through assumptions favorable to sustainability-oriented menu change. To address this, the research team engaged in reflexive discussions throughout the analytic process, explicitly considering how commitments to public health, sustainability, and school meal policy might shape coding decisions and theme development. Attention was paid to accounts that complicated or challenged project expectations, including students' emphasis on taste, satiety, familiarity, and everyday school meal routines over climate-

related considerations. Disagreements and alternative interpretations were used to deepen the analysis and clarify theme boundaries. To enhance transparency in reporting the reflexive thematic analysis, selected examples of analytic coding and theme development are provided in [Supplementary Material 4](#).

2.4. Integration of quantitative and qualitative data

Quantitative and qualitative findings were integrated at the interpretation stage (Creswell, 2014). Integration focused on identifying areas of convergence (where findings aligned), complementarity (where qualitative findings helped explain statistical associations), and divergence (where patterns differed across methods).

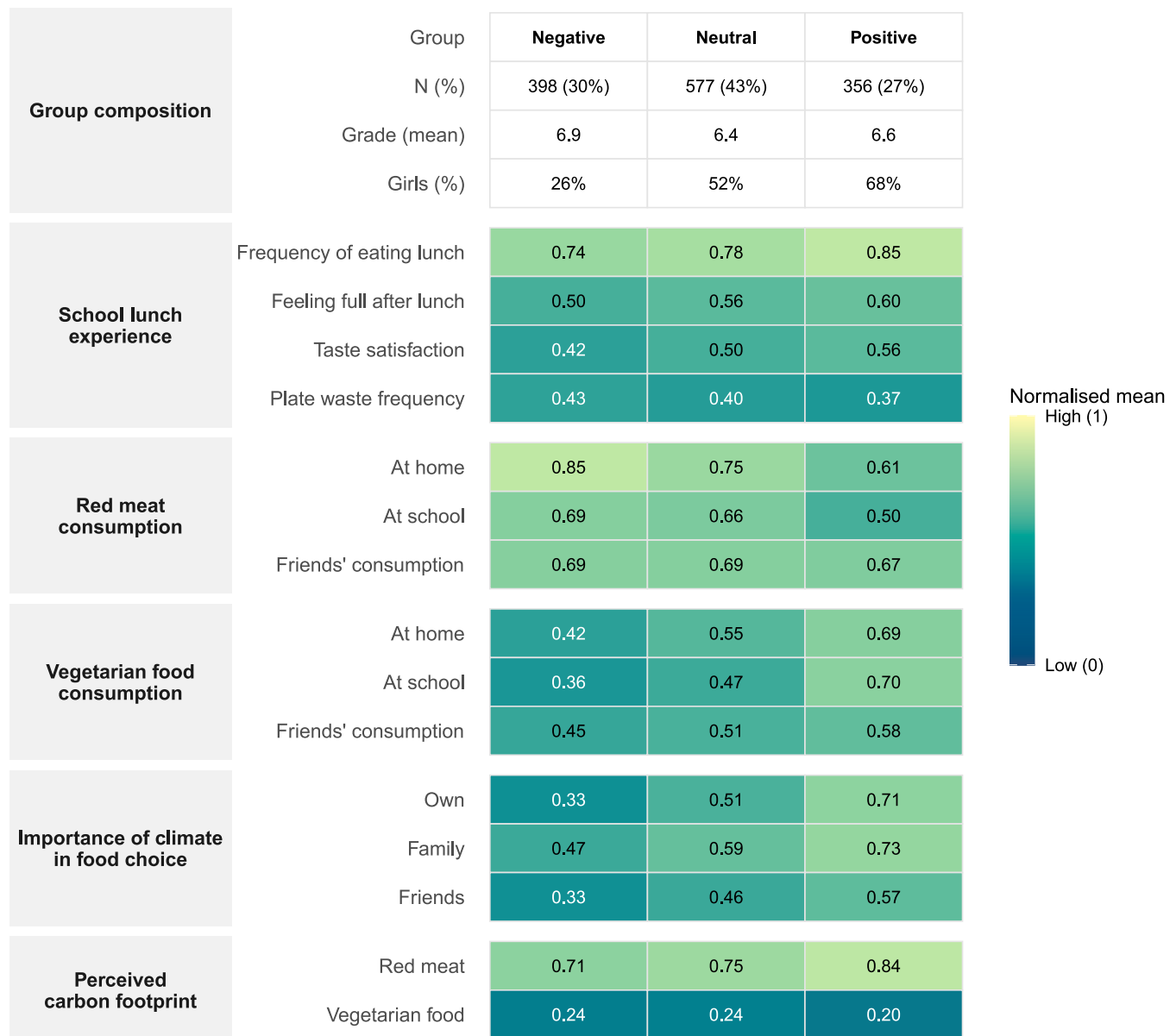


Fig. 1. Heat map of student-reported survey measures by support for climate-friendly school meals.

Note. Support groups are based on an attitude index summing two items: support for low-carbon recipes and support for all-vegetarian days. The index ranged from 0 to 8 and was divided into negative (0–2), neutral (3–5), and positive (6–8) for descriptive visualization only; regression analyses used the continuous index. The top block shows group composition, and the remaining cells show normalized group means. Colors and cell values indicate lower to higher normalized means. All measures are student reported. Family and friends variables refer to students' perceptions of others' food choices or views.

2.5. Ethical considerations

The study received exemption with advisory opinion from the Swedish Ethical Review Authority (No. 2021–03896). The study was conducted in accordance with the Declaration of Helsinki. For the survey component, students and guardians were informed about the study via a school newsletter before data collection. Participation was voluntary and anonymous; consent and assent were implied by completion of the survey. For the qualitative sessions, written parental consent and verbal student assent were obtained before participation.

3. Results

3.1. Quantitative findings

Descriptive patterns are shown in Fig. 1, which presents normalized mean values for key variables across students with negative (0–2), neutral (3–5), and positive (6–8) levels of support for climate-friendly school meals. The neutral group was the largest, comprising just over 40% of students, while the negative and positive groups each comprised approximately 30%, with the negative group slightly larger.

The distribution also differed by sex: roughly three-quarters of students in the negative group were boys, whereas about 70% of those in the positive group were girls. Across groups, students consistently perceived vegetarian food as having a substantially lower carbon footprint than red meat. Differences were observed across groups in several other domains, including red meat consumption, vegetarian food consumption, the importance of climate in food choice, and school lunch experiences. A full descriptive table is provided in [Supplementary Material 5](#).

A total of 1268 students were included in the quantitative analyses. Paired *t*-test results indicated that students preferred changing recipes to reduce meat ($M = 2.03$, $SD = 1.28$) over increasing the number of vegetarian days ($M = 1.87$, $SD = 1.31$), a difference that was statistically significant but small in magnitude, $t(1330) = 6.31$, $p < .001$, $d = 0.17$. The same pattern was observed among both girls, $t(643) = 4.42$, $p < .001$, and boys, $t(686) = 4.51$, $p < .001$.

The multivariable linear regression model explained 48.7% of the variance in attitudes towards climate-friendly school meals ($R^2 = 0.487$, adj. $R^2 = 0.481$, $F(13, 1254) = 91.40$, $p < .001$). Fig. 2 presents the standardized beta coefficients, and [Supplementary Material 5](#) provides the full regression table.

Being female (vs. male) was positively associated with supportive attitudes towards climate-friendly school meals ($b = 0.889$, $p < .001$). Grade level was negatively associated with supportive attitudes ($b = -0.142$, $p < .001$), indicating lower support among older students.

Higher red meat consumption at home ($b = -0.200$, $p < .001$) and at school ($b = -0.177$, $p < .001$) was negatively associated with supportive attitudes. In contrast, vegetarian consumption at school was strongly positively associated with supportive attitudes ($b = 0.520$, $p < .001$), and vegetarian consumption at home was also positively associated ($b = 0.176$, $p < .001$).

Students' own consideration of climate in food choice was among the strongest associations with supportive attitudes ($b = 0.645$, $p < .001$). Perceived climate importance among family members ($p = .158$) and friends ($p = .085$) was not significantly associated with supportive attitudes. Similarly, perceived peer consumption of red meat ($p = .754$) or vegetarian food ($p = .294$) was not significantly associated with supportive attitudes.

Perceiving red meat as having a higher carbon footprint was

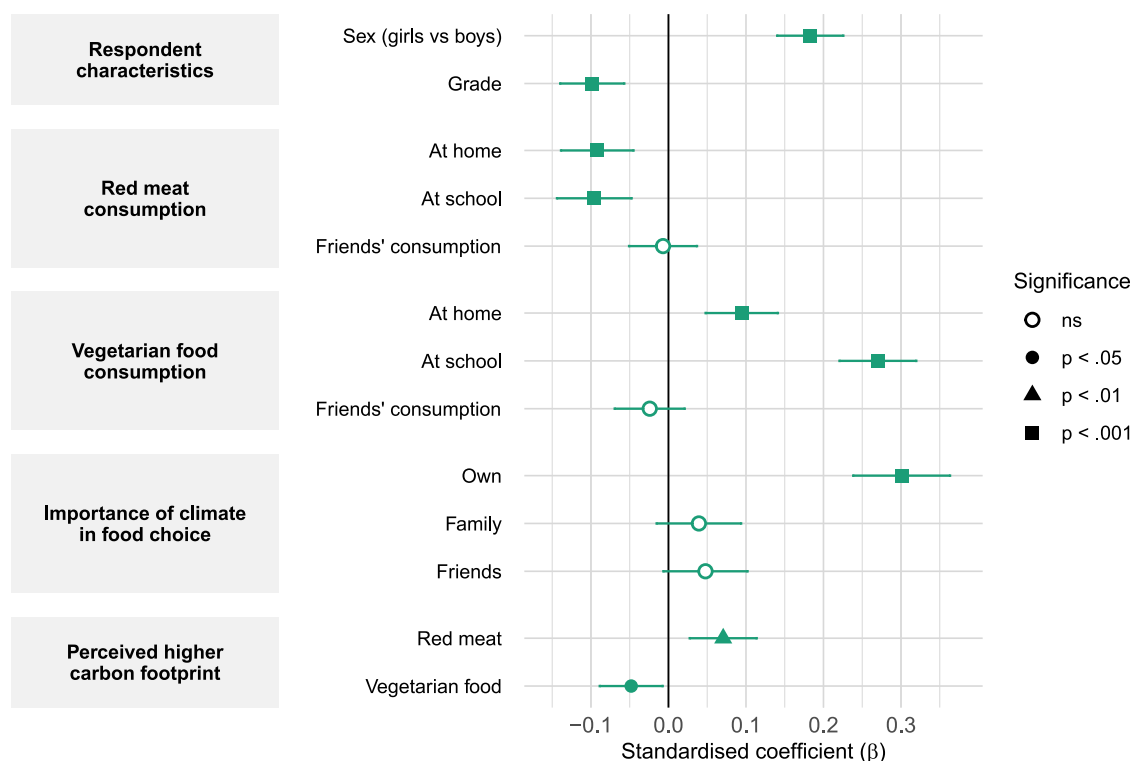


Fig. 2. Standardized coefficient plot for attitudes toward climate-friendly school meals.

Note. Points show standardized coefficients from an OLS regression model; horizontal lines show 95% confidence intervals. The outcome combines support for lower-carbon recipe changes and more all-vegetarian days, with higher values indicating more positive attitudes. Coefficients were standardized using fixed reference standard deviations from the full sample. All measures are based on student survey responses; peer and family measures refer to respondents' perceptions of others' food choices and views.

positively associated with supportive attitudes ($b = 0.174$, $p = .001$), whereas perceiving vegetarian food as having a higher carbon footprint was negatively associated with supportive attitudes ($b = -0.110$, $p = .020$).

Support for all-vegetarian days and low-carbon recipe reformulation showed very similar patterns of association across variables. The main differences were that support for increased vegetarian days was somewhat more strongly associated with vegetarian food consumption at home and with perceiving red meat as having a high carbon footprint. Overall, the results support the use of a combined measure of attitudes toward climate-friendly school meals; full item-level models are provided in [Supplementary Material 5](#).

3.2. Qualitative findings

The themes below are presented as interpretive patterns of meaning developed through reflexive engagement with the qualitative data. They are not intended to represent the frequency of responses, but to illuminate how students made sense of climate-friendly school meals in relation to everyday school lunch practices, peer norms, food preferences, and understandings of climate impact. Across the themes, students did not reject climate-friendly change in principle. Rather, their accounts suggested that acceptability depended on whether such changes could be incorporated into existing expectations of school lunch as familiar, tasty, filling, and socially acceptable. To protect participant confidentiality, quotations are attributed by age group only and not to individual schools. Selected examples of analytic coding and theme development are provided in [Supplementary Material 4](#).

3.2.1. Theme 1: "As long as it tastes good"

Across the qualitative sessions, students positioned taste as the primary condition through which climate-friendly school meals were evaluated. Climate considerations were not absent from students' accounts, but they were rarely described as guiding food choices in the moment of eating. Instead, students emphasized hunger, cravings, satiety, and whether the food was enjoyable or edible. One older student explained that when choosing food at school, "I think about how hungry I am and what I'm craving" (grades 7–9), while a younger student summarized the central criterion as "that it's good!!" (grades 4–6). These accounts suggest that climate-friendly meals were judged first as school meals, rather than as environmental interventions.

Taste was not discussed only as individual preference. Students repeatedly linked acceptability to the practical quality of the food: whether pasta or rice was properly cooked, whether vegetarian dishes were dry, whether soups were filling, whether bread or sauces were available, and whether vegetarian alternatives were prepared well. This was especially evident in comments about vegetarian dishes described as repetitive, dry, poorly seasoned, or insufficiently satisfying. For example, younger students criticized vegetarian dishes because "the falafel is hard and crumbly" (grades 4–6), while another described couscous as "like Sahara" because it was so dry (grades 4–6).

This theme, therefore, captures more than a general preference for tasty food. Taste functioned as a gatekeeping condition for whether climate-friendly change could be accepted at all. Students could support the environmental rationale behind reduced meat, but this support was fragile if the result was perceived as less tasty, less filling, or less familiar. As one younger student put it when discussing soy mince as a possible replacement: "Okay, as long as it tastes good" (grades 4–6).

3.2.2. Theme 2: Visible versus invisible change

Students distinguished between climate-friendly changes that were incorporated into familiar meals and changes that were experienced as overt vegetarian substitution. Less visible reformulation, such as reducing the amount of meat in existing dishes, was often described as more acceptable because it did not disrupt students' expectations of the meal. One older student explained that reducing meat within recipes

would lead to fewer complaints because "fewer people would notice" (grades 7–9).

In contrast, visible vegetarian substitution was more likely to be interpreted as a loss of familiar foods. Students noticed when favorite dishes such as tacos, Tex-Mex, or meat-based meals disappeared or changed. In these cases, climate-friendly reformulation was not evaluated only in terms of environmental benefit, but as a change to the recognizable structure of the school meal. Some younger students described the changes as "sad" because there were fewer meat meals, even while acknowledging that the changes were "good for the climate and sustainable development" (grades 4–6).

The distinction between visible and invisible change also depended on labeling and meal format. Vegetarian meals that already fit familiar categories, such as potato and leek soup, schnitzel, nuggets, or soy mince in a Tex-Mex format, were often described as easier to accept. By contrast, meals marked by ingredients already associated with unpopular vegetarian food, such as lentils or repetitive stews, were expected to provoke resistance. One older student explained that a familiar vegetarian soup would attract fewer complaints because "there's no meat in it, but it is a regular school meal" (grades 7–9). The analysis, therefore, suggests that acceptability was shaped not only by the amount of meat removed but by whether the change preserved a recognizable and desirable meal identity.

3.2.3. Theme 3: Meat as the normal meal standard

Students' accounts suggested that meat continued to operate as a normative reference point for what counts as a proper, satisfying school meal. This was evident in students' stated preferences for meat-based dishes, concerns about getting full, and comments that peers expected protein to come from meat. One younger student stated, "I would like them to keep as much meat as it used to be, because I like meat very much" (grades 4–6), while an older student suggested that many students think "protein only comes from meat" (grades 7–9).

However, the theme is not simply that students prefer meat. Rather, meat appeared to carry meanings of normality, adequacy, and reliability. Vegetarian meals could be accepted when they resembled familiar meat-based formats or were perceived as equally satisfying, but they were more vulnerable to being judged as inferior when labeled or recognized as vegetarian. Students described peers as disappointed when meals were vegetarian, predicted that classmates would "have hated it" (grades 4–6), and worried that students might stop eating if vegetarian options were not sufficiently appealing.

At the same time, attachment to meat did not necessarily indicate a lack of environmental awareness. Students could describe the climate impact of meat, including resource use, transport, and methane emissions, while still expressing a preference for meat or concern that vegetarian meals would not be as satisfying. This coexistence is analytically important because it suggests that knowledge about meat's climate impact did not automatically unsettle meat's position as the default meal standard.

3.2.4. Theme 4: climate knowledge with low lunchroom salience

Students demonstrated awareness that food choices affect the climate. They discussed meat production, transport, food waste, locally produced foods, animal agriculture, and resource use. For example, one younger student stated that "red meat emits very, very much" (grades 4–6), while an older student explained that "cows ... fart methane gases, which is bad for the environment" (grades 7–9). Other students described how food transported from other countries, animal slaughter, and food waste contributed to climate impacts.

Yet this knowledge was often described as having low salience in everyday eating situations. Students commonly said they did not think much about climate when choosing school lunch, even though they recognized its importance when asked directly. One older student explained, "When I'm choosing something to eat, I think about how good it is instead of how much it affects the climate, because then I'm hungry"

(grades 7–9). A younger student similarly said, “Once I take the food and eat, I don’t think about it at all. But then when I’m asked, I think about it” (grades 4–6).

This theme therefore captures a gap between knowledge and practice, but not simply as a lack of information. Students’ accounts suggest that the lunchroom is a setting where immediate bodily needs, food routines, peer norms, time pressures, and perceptions of food quality make climate considerations less actionable. Climate-friendly eating was also socially situated: students anticipated peer reactions, described classmates as complaining about vegetarian food, and sometimes contrasted their own views with those of friends or family members. For example, when discussing how classmates might respond to vegetarian changes, one younger student said, “They would have hated it” (grades 4–6). Students also sometimes contrasted responses within families, with one younger student noting, “My mum would probably think it’s good, but my dad definitely wouldn’t” (grades 4–6).

3.2.5. Summary of qualitative themes

Together, the themes suggest that students’ acceptance of climate-friendly school meals depended less on whether they understood the environmental rationale and more on whether changes could be made compatible with the everyday meanings and demands of school lunch. Climate-friendly meals were more acceptable when they were tasty, filling, familiar, well-prepared, and not experienced as a visible loss of valued foods.

3.3. Integration of quantitative and qualitative findings

Integration of the findings showed convergence and complementarity across the quantitative and qualitative strands. Quantitatively, greater personal consideration of climate in food choices and higher vegetarian consumption at school were the variables most strongly associated with supportive attitudes. The qualitative findings help contextualize these associations. Students did not reject vegetarian or lower-carbon meals in principle, but described acceptance as conditional on taste, satiety, and familiar meal formats. Thus, higher rates of vegetarian consumption at school and at home may reflect both greater familiarity with vegetarian meals and a preference for these foods, making climate-friendly meal changes feel less disruptive.

The qualitative findings also qualified the role of climate awareness. In the survey, students generally recognized that vegetarian food had a substantially lower carbon footprint than red meat, including among those with lower support for climate-friendly school meals. Perceived carbon-footprint differences were associated with support in the expected direction, but less strongly than personal climate concern and vegetarian consumption at school. Similarly, qualitative participants often recognized the climate impact of meat, but described climate considerations as secondary to taste, hunger, and everyday meal expectations. Together, these findings suggest that awareness of food-related carbon footprints may support acceptance but is not sufficient on its own to explain it.

A further area of convergence concerned the comparison between meat-reduction strategies. Quantitatively, students expressed somewhat greater support for lower-carbon recipe reformulation than for increasing the number of all-vegetarian days. Qualitatively, students likewise described subtler changes within familiar dishes as more acceptable than overt vegetarian-only provision. This suggests that acceptance was shaped not only by whether meat was reduced, but also by how visible the change was and whether it preserved familiar, socially recognized meal formats.

A partial divergence concerned peer-related findings. The survey captured descriptive peer norms, that is, students’ perceptions of how often their friends ate red meat or vegetarian food, and these were not significantly associated with supportive attitudes. In the qualitative sessions, students instead described how other students might react to meat reduction or vegetarian meals. These accounts do not show that

peer reactions shaped participants’ own support or behavior, but they suggest that vegetarian and low-carbon meals were understood within a social context where some foods were seen as more or less acceptable.

Overall, the integrated findings indicate that students’ acceptance of climate-friendly school meals was shaped by climate-oriented values, but also by whether meat reduction preserved taste, satiety, familiarity, and social acceptability.

4. Discussion

This study shows that students’ acceptance of climate-friendly school meals was shaped by both climate-oriented food values and everyday meal experiences. Although students generally recognized the climate relevance of meat reduction, support for climate-friendly school meals depended strongly on whether changes preserved taste, satiety, familiarity, and socially acceptable meal formats. Students expressed somewhat greater support for lower-carbon recipe reformulation than for increasing all-vegetarian days, suggesting that the acceptability of meat reduction depends not only on the climate goal itself, but also on how visibly and disruptively it changes the school meal. By integrating survey findings with students’ own accounts, this study contributes to the school meal and sustainable diet literature by showing how students differentiate lower-carbon meal changes in everyday school eating.

4.1. The potential of subtle recipe reformulation

A central insight across methods was the distinction between subtle meat reduction in familiar dishes and explicit vegetarian-only days. In the qualitative sessions, students anticipated greater resistance when vegetarianism was foregrounded. This pattern was reinforced by the quantitative results, in which support for recipe reformulation was significantly higher than for increasing the number of all-vegetarian days. Together, these findings suggest that the visibility of meat reduction matters for acceptability. This resonates with behavioral “stealth” or “nudge” approaches to dietary change (Adkisson, 2008; Garnett et al., 2019), where small modifications within familiar formats reduce psychological reactance.

Our findings suggest that reformulation strategies (e.g., reducing meat content in mixed dishes) may generate less social resistance than complete elimination strategies. This supports modelling work indicating that gradual reduction approaches may be more feasible in institutional settings (Springmann, Wiebe, et al., 2018).

4.2. Taste as a prerequisite for accepting sustainable eating

Our findings reinforce evidence that taste remains a primary driver of food choice (Fleming et al., 2021; Kourouniotis et al., 2016; Story et al., 2002). Even students who demonstrated knowledge of food-related climate impacts described food choice as guided by hunger and craving. This aligns with research that demonstrates cultural preferences and sensory experiences, such as taste and texture, can drive immediate sensory and affective processes over abstract, deliberative reasoning (Berti et al., 2025).

In school contexts, this suggests that climate-oriented interventions risk rejection if they compromise perceived palatability, not because students necessarily reject sustainability goals, but because taste operates as a non-negotiable condition of acceptability. At the same time, previous school meal intervention studies indicate that vegetarian menus and lower-carbon recipe reformulation can be introduced without necessarily reducing intake, increasing waste, or lowering satisfaction, particularly when changes are designed to preserve familiarity and meal appeal. For example, the OPTIMAT intervention showed that a greenhouse gas-reduced, nutritionally adequate, and affordable school lunch menu could be implemented without significant changes in plate waste, consumption, or school lunch satisfaction (Colombo et al., 2020). Similarly, research on vegetarian school lunches, including

Ghent's "Thursday Veggie Day" and the mandatory vegetarian day in Helsinki, suggests that vegetarian initiatives may be feasible in school settings, although mandatory vegetarian days may also generate non-compliance or be experienced as choice-restrictive, particularly in the short term (De Keyser et al., 2012; Lombardini & Lankoski, 2013). Together, these findings suggest that the challenge is not meat reduction per se, but how sustainable meal changes are translated into meals that students recognize as tasty, filling, and acceptable, with prior research also showing that menu framing and taste-focused descriptions can influence plant-based food choice (Bacon & Krpan, 2018; Turnwald et al., 2019).

4.3. Meat as cultural and social norm

Students' accounts reflected what has been described as the "meat norm" (Kim et al., 2024; Malila et al., 2025; Rao et al., 2025). Meat was treated as a default source of protein and as central to a "proper meal." Vegetarian dishes were sometimes described as inferior or disappointing, particularly when explicitly labeled as vegetarian.

Research shows that meat consumption is associated with identity, tradition, and masculinity (Randers & Thøgersen, 2023; Rothgerber, 2013; Rozin et al., 2012). Although masculinity was not explicitly discussed in the qualitative data, students' references to anticipated peer rejection and resistance suggest that meat reduction may carry symbolic implications beyond taste. This interpretation is also consistent with the survey findings, in which boys expressed significantly less support for climate-friendly school meals than girls. These findings suggest that responses to meat reduction may be shaped not only by sensory expectations but also by gendered food norms and the social meanings attached to meat.

Importantly, however, students did not reject all vegetarian foods. Some vegetarian items, including schnitzel and nuggets, were described as acceptable when they were perceived as tasty, familiar, and consistent with recognizable school meal formats. This suggests that resistance may be less about plant-based content per se and more about whether meals are perceived to fit students' expectations of what a satisfying school lunch should be.

4.4. Climate awareness without behavioral salience

Students demonstrated awareness that red meat has a high carbon footprint and vegetarian food has a low carbon footprint, both in qualitative discussions and survey data. However, the climate was rarely described as salient in everyday lunch decisions in the qualitative data. This gap between knowledge and action is well documented in research on sustainable food consumption (ElHaffar et al., 2020; Hartmann & Siegrist, 2020; Kollmuss & Agyeman, 2002).

Quantitatively, students' own climate concern was strongly associated with supportive attitudes, yet peer consumption was not. Qualitatively, however, peers were frequently invoked when discussing likely resistance. This divergence suggests that peer dynamics may operate through anticipated social reactions and reputational concerns rather than through measurable similarity in consumption. Future work could incorporate explicit measures of perceived social norms, including injunctive and descriptive norms, to better capture this mechanism (Higgs, 2015; Salmivaara et al., 2021).

4.5. Gender differences

Girls reported more supportive attitudes towards climate-friendly school meals in the survey, and being a girl was strongly positively associated with supportive attitudes in the regression model. This aligns with literature indicating that women and girls often report higher environmental concern and lower meat consumption (Graça et al., 2015; Hunter et al., 2004; Sanchez-Sabate & Sabaté, 2019). One qualitative account also contrasted maternal and paternal responses to meat

reduction, suggesting that climate-oriented eating may sometimes be interpreted through gendered family norms. This interpretation should be treated cautiously, but together with the quantitative finding that girls reported more supportive attitudes than boys, it highlights the importance of considering gendered food norms when designing interventions.

4.6. Implications for school meal design

Our findings indicate that taste and sensory appeal act as pre-requisites for the acceptance of climate-friendly school meals. Students did not oppose such changes in principle; rather, acceptance was conditional on meals meeting expectations of taste and adequacy. While awareness of the relative carbon footprint of different foods had a weaker association with support than other factors, this should not be interpreted as evidence that knowledge is unimportant. Since our study cannot determine whether support would have been lower in the absence of such awareness, climate communication and education may still play a useful supporting role in fostering understanding and acceptance. However, such communication should be designed carefully, since our findings suggest that overt changes were less acceptable than subtler recipe reformulation, and previous research indicates that explicitly highlighting vegetarian or meat-reduction aspects can reduce choice or acceptability. For meal design, the findings suggest that climate-friendly changes are more likely to be acceptable when they preserve sensory quality, build on familiar formats, and use gradual reformulation rather than abrupt or overtly moralizing approaches.

4.7. Strengths and limitations

This study has several strengths. First, the convergent mixed-methods design enabled integration of survey data with qualitative sessions, providing both breadth and depth in understanding students' acceptance and perceptions of climate-friendly school meals. The use of qualitative sessions allowed students to express views beyond the constraints of structured survey items and reduced reliance on literacy skills required for self-report questionnaires. Qualitative data were collected directly by members of the research team, and analytic credibility was strengthened through reflexive discussions and triangulation with field notes and quantitative findings. The relatively large survey sample enhances the robustness of the quantitative analyses and supports the integration of findings across methods.

Several limitations should be acknowledged. The study was planned before the COVID-19 pandemic and implemented shortly after restrictions were lifted, which limited in-person engagement with school personnel during the planning phase. The survey was administered during regular classroom time and relied on teachers allocating time for completion, which may have led to some variation in implementation across classrooms. Non-participation was therefore likely driven mainly by student absence on the day of data collection and differences in teacher implementation fidelity. Nevertheless, the response rate was within the range commonly seen in school-based survey research.

As is generally the case in cross-sectional studies using self-reported survey measures, the quantitative findings should be interpreted cautiously. The observed associations cannot establish causal direction, and some responses may reflect broader attitudes toward meat reduction as well as the construct being measured. For example, ratings of the carbon footprint of red meat and vegetarian food may partly reflect support for or resistance to plant-based meals, rather than only factual understanding.

The qualitative component included only two schools within one municipality, which may limit transferability to other contexts. One planned focus group was conducted as an individual interview due to limited attendance, eliminating opportunities for group interaction in that session. As with all qualitative sessions, peer dynamics may have influenced responses; however, separating younger and older students

and triangulating findings with survey data helped mitigate this risk.

Further, because the qualitative sessions were conducted after the intervention, students' accounts may have been shaped by their exposure to the low-carbon menu. In the school assigned to the menu plus information condition, the informational materials may also have increased students' awareness of the climate impact of dietary choices. The qualitative findings should therefore be interpreted as reflecting students' perceptions after experiencing the intervention, rather than as pre-intervention views.

In addition, parental educational attainment was relatively high in the participating schools. This may limit transferability to school contexts with different socioeconomic profiles and may have influenced students' exposure to, or familiarity with, climate and sustainability-related food norms. However, previous OPTIMAT research using a similar menu-optimization approach in schools with substantially lower parental education levels did not find reduced meal acceptance and identified similar student-reported barriers and facilitators to accepting plant-based meals (Eustachio Colombo et al., 2020, 2021).

Finally, although reflexive thematic analysis was conducted inductively, interpretation is inevitably shaped by researchers' perspectives. The research team remained attentive to positionality and potential power imbalances between adult researchers and child participants throughout data collection and analysis.

5. Conclusion

This study shows that students' acceptance of climate-friendly school meals is conditional rather than absent. Across methods, students appeared more accepting of lower-carbon recipe reformulation than of increasing all-vegetarian days, suggesting that acceptability depends not only on meat reduction itself, but also on how it is implemented and experienced. Students also showed awareness of the relative carbon footprint of red meat and vegetarian food, yet climate concerns were rarely central in their accounts of everyday meal choice.

These findings corroborate earlier research showing that taste, familiarity, and meal norms shape acceptance of meat reduction in school meals more strongly than sustainability concerns alone. They also indicate that lower-carbon recipe reformulation may complement vegetarian-only days as a practical strategy for sustaining acceptance and intake in school meals. Future research should further examine how schools can design, test, and communicate lower-carbon meals in ways that fit students' everyday expectations of school food, while also addressing the social meanings and peer dynamics that shape acceptance.

CRedit authorship contribution statement

Monica Hunsberger: Writing – review & editing, Writing – original draft, Visualization, Project administration, Investigation, Funding acquisition, Formal analysis, Conceptualization. **Razan Zaid A. Fatani:** Writing – review & editing, Investigation, Formal analysis. **Erik André:** Writing – review & editing, Visualization, Project administration, Methodology, Investigation, Formal analysis, Conceptualization.

Ethics declaration

Written informed consent to take part in the study and to publish the article has been obtained from all participants or their legal representatives. The privacy rights of participants have been observed.

This study was performed in compliance with relevant laws, regulatory frameworks and guidelines where the research took place. The Swedish Ethical Review Authority (Etikprövningsmyndigheten) granted an exemption. The authors provided the following explanation: The study was reviewed by the Swedish Ethical Review Authority, which issued an exemption with advisory opinion (No. 2021–03896). Formal ethical approval was not required because the study did not fall under

the provisions requiring approval under the Swedish Ethical Review Act. The study involved voluntary, non-invasive survey and qualitative data collection about school meals and did not involve physical intervention, collection of biological material, or processing of sensitive personal data requiring formal ethical approval. The study was nevertheless conducted in accordance with the Declaration of Helsinki and relevant ethical principles for research involving children. Students and guardians were informed about the study before survey data collection, and participation was voluntary and anonymous. For the qualitative sessions, written parental consent and verbal student assent were obtained before participation.

Data availability

The anonymized quantitative survey dataset supporting the findings of this study is available in Mendeley Data: [Hunsberger and André \(2026\)](#), “OPTIMAT Lund: Anonymized quantitative survey data on students' perceptions of climate-friendly school meals”, Mendeley Data, V1, <https://doi.org/10.17632/2bhhgcmvk6.1>. The questionnaire and qualitative session guide are provided in Supplementary Materials 1 and 3, respectively. The raw qualitative data are not publicly available because they consist of transcripts from qualitative sessions with schoolchildren. Due to the age of participants, the school-based setting, and the contextual nature of the transcripts, public sharing could compromise participant confidentiality even after anonymization. Participants and guardians did not provide consent for public sharing of full qualitative transcripts. Anonymized excerpts supporting the qualitative analysis are included in the article, and selected examples of analytic coding and theme development are provided in [Supplementary Material 4](#). Additional non-identifiable information about the qualitative materials may be made available from the corresponding author upon reasonable request and subject to ethical, legal, and confidentiality restrictions.

Declaration of generative AI and AI-assisted technologies in the manuscript preparation process

During the preparation of this work, the authors used ChatGPT for suggested wording, R coding assistance, and table formatting. The authors reviewed and edited the output as needed and take full responsibility for the content of the published article.

The study involved human participants and was conducted in accordance with the Declaration of Helsinki. The study received exemption with advisory opinion from the Swedish Ethical Review Authority (No. 2021–03896). For the survey component, students and guardians were informed about the study before data collection; participation was voluntary and anonymous, and consent and assent were implied by completion of the survey. For the qualitative sessions, written parental consent and verbal student assent were obtained before participation. This study did not involve animals.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.appet.2026.108793>.

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