

Institut für Ernährungswissenschaft
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**Nachhaltige Schulentwicklung – Inkrementelle Konzepte für gesunde
Ernährungsgewohnheiten und nachhaltige Transformation des Schulalltags**

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„Die Zukunft hängt davon ab, was wir heute tun.“

Mahatma Gandhi

„For nothing will be impossible with God.“

Lukas 1:37

Mit Genehmigung des Fachbereichs Agrarwissenschaften,
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Gießen, Dezember 2025

Monika Bauer

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1. EINLEITUNG

Ein Berufsbildungszentrum (BBZ), das viele Schulformen bis hin zum Oberstufengymnasium vereint, erfüllt eine Vielzahl bedeutender Aufgaben innerhalb des deutschen Bildungssystems. Es dient als zentrale Bildungsinstitution, die berufliche und allgemeinbildende Bildung miteinander verzahnt. Eine seiner Hauptaufgaben besteht darin, jungen Menschen verschiedene Bildungswege zu ermöglichen – von der dualen Ausbildung über vollzeitschulische Berufsbildungsgänge bis hin zum Erwerb der allgemeinen Hochschulreife [1]. Dabei bietet das BBZ die Ausbildungsvorbereitung, die Berufsfachschulen, die Berufsschulen, die Fachoberschulen mit verschiedenen Fachbereichen sowie das berufliche Oberstufengymnasium mit verschiedenen Fachbereichen an. Eine weitere zentrale Aufgabe ist die berufliche Orientierung und Vorbereitung auf den Arbeitsmarkt. Das BBZ vermittelt nicht nur fachliches Wissen, sondern auch Schlüsselqualifikationen wie Teamfähigkeit, Kommunikationsfähigkeit und Problemlösungskompetenz [2]. In Kooperation mit Unternehmen unterstützt es Praktika und Projekte, die den Praxisbezug der Ausbildung sichern. Auch die Begleitung von Übergängen – beispielsweise von der Schule in den Beruf oder in ein Studium – ist Teil des pädagogischen Auftrags. Darüber hinaus übernehmen Berufsbildungszentren eine wichtige Rolle in der Integration. Sie bieten spezielle Programme für Jugendliche mit Migrationshintergrund oder Unterstützungsbedarf an und arbeiten eng mit Beratungsstellen zusammen [3]. Zudem zählen auch die individuelle Förderung und Inklusion zu den pädagogischen Leitlinien. Lehrerinnen und Lehrer an BBZs sind dabei nicht nur Fachvermittler, sondern auch Ansprechpartner für persönliche und soziale Anliegen der Schülerinnen und Schüler. Das Berufsbildungszentrum ist aber weit mehr als ein Ort der Wissensvermittlung. Es ist eine moderne Bildungseinrichtung mit sozialem, ökonomischem und ökologischem Auftrag. Ein zukunftsweisender Schwerpunkt liegt zunehmend im Bereich der Bildung für nachhaltige Entwicklung (BNE). Berufsbildungszentren sollen laut UNESCO-Richtlinien junge Menschen dazu befähigen, verantwortungsbewusstes Denken und Handeln im Sinne der Nachhaltigkeit zu entwickeln [4]. Bisher liegen keine empirischen Studien vor, die den aktuellen Stand der nachhaltigen Schulentwicklung in Berufsbildungszentren systematisch untersuchen. Diese Forschungslücke bildet die Grundlage für diese Arbeit.

1.1. Kiosk-/Cafeteria-Verpflegungsangebote im Kontext der BNE

Schülerinnen und Schüler sowie Lehrerinnen und Lehrer verbrauchen einen erheblichen Teil ihrer täglichen Energie im schulischen Umfeld [5, 6]. Eine ernährungsphysiologisch ausgewogene Ernährung ist entscheidend für die Optimierung der Entwicklung, des Gesundheitszustands und der schulischen Leistungen [7–10]. Die in der Schule verzehrten Lebensmittel und Getränke enthalten jedoch häufig viel Energie und wenig Nährstoffe [11, 12]. Einer australischen Studie zufolge werden durchschnittlich 37% der täglichen Energiezufuhr in der Schule aufgenommen. Es wurde festgestellt, dass energiereiche Lebensmittel und Getränke in der Schule mehr zur Energieaufnahme beitragen als außerhalb der Schule [13]. Der Setting-Ansatz wurde erstmals 1986 in der Ottawa-Charta als Konzept der Gesundheitsförderung formuliert und diente als Grundlage für das *Healthy Cities Project* der Weltgesundheitsorganisation (WHO) [14]. Ein WHO-Interventions-Beispiel ist das gesundheitsfördernde Schulsetting [6, 5]. Gesundheitsförderung ist ein zentraler Bestandteil nachhaltiger Schulentwicklung, da sie das Wohlbefinden der Lernenden langfristig stärkt und gesundheitsbewusstes Verhalten im Alltag fördert. Im Rahmen einer BNE ist sie eng verknüpft mit Themen wie Ernährung, Bewegung und psychosoziale Gesundheit [15].

In deutschen Berufsbildungszentren sind Themen zur gesunden Ernährung in zahlreichen Schularten etabliert. Insbesondere im Fach Gesundheit der gymnasialen Oberstufe werden vertiefende Inhalte zu gesunder, ausgewogener Ernährung und die Empfehlungen der Deutschen Gesellschaft für Ernährung vermittelt [16]. Ernährungswissen ist die Fähigkeit, Konzepte gesunder Ernährung zu verstehen, so dass Essverhalten und -gewohnheiten beeinflusst werden können [17, 18]. Das Bundesforschungsinstitut für Ernährung und Lebensmittel (Max Rubner-Institut) definiert Ernährungsverhalten als „die Gesamtheit der geplanten, spontanen oder gewohnheitsmäßigen Handlungen von Individuen oder sozialen Gruppen, mit denen Lebensmittel beschafft, zubereitet, verzehrt und weiterverarbeitet werden. Dabei umfasst das Ernährungsverhalten sowohl Einflussfaktoren als auch Wirkungen aus den Dimensionen Gesundheit, Umwelt, Gesellschaft und Wirtschaft entlang der gesamten Lebensmittel-Produktkette“ [19].

Ein gesundes Verpflegungsangebot in der Schule ist ein vielversprechender Ansatz, die Schulgemeinschaft an eine gesundheitsfördernde Ernährung heranzuführen und zur Prävention von Zivilisationskrankheiten beizutragen [20–26]. Die Schulverpflegung

hat sich in den letzten Jahren verändert. In vielen Ländern gibt es inzwischen Standards für die Schulverpflegung, aber es gibt noch viel Raum für Verbesserungen bei der Umsetzung [20, 27–30]. Deutsche Berufsbildungszentren bieten kein Mittagessen an, sondern verfügen in der Regel über einen Kiosk oder eine Cafeteria, die von einem externen Anbieter betrieben wird. Ein Kiosk bietet ein kleines Sortiment mit einer geringen Warentiefe für den kurzfristigen Bedarf an, gelegentlich in Verbindung mit einer Getränkebar. In Schulen handelt es sich in der Regel um einen Raum mit einer kleinen Verkaufstheke, der zum Schulhof hin mit einem Rollladen geöffnet ist. Eine Bestuhlung, wie sie bei einer Cafeteria gegeben ist, ist nicht vorhanden. Die Empfehlungen der Deutschen Gesellschaft für Ernährung wurden dort bisher nicht umgesetzt. Das Angebot von süßen und salzigen Snacks, Schokoriegeln und zuckerhaltigen Getränken zum Frühstück und/oder als Zwischenmahlzeit in Schulen ist oft umstritten [31, 32], und es bedarf verbindlicher Richtlinien zur Qualitätssicherung in Schulkiosken. Angesichts der Bedeutung einer gesundheitsförderlichen und ökologisch verantwortungsvollen Verpflegung im schulischen Kontext ist die Einführung verbindlicher Qualitätsstandards für Schulkioske notwendig, welche sowohl Aspekte der Lebensmittelsicherheit und -qualität als auch die Einhaltung von Nachhaltigkeitskriterien systematisch berücksichtigen. Bislang liegen jedoch keine empirischen Studien vor, die die Umstellung eines Schulkiosks auf ein gesundheitsorientiertes Angebot systematisch untersuchen und die Umsetzung begleiten.

1.2. Nachhaltigkeit im Zusammenhang mit Schulentwicklung

Nachhaltigkeit hat sich in den letzten Jahren so stark entwickelt wie kaum ein anderes Thema [33]. Schon früh wurde der Begriff „Nachhaltige Nutzung“ im Zusammenhang mit der Forstwirtschaft verwendet. Bäume durften nur in dem Maße gefällt werden, wie sie nachwachsen konnten, um die Ressourcen langfristig zu schonen [34, 35]. Heutzutage haben die verschiedenen Definitionen des Begriffs Nachhaltigkeit grundlegende Gemeinsamkeiten. Erstens ist Nachhaltigkeit immer auf die Gegenwart und die Zukunft ausgerichtet und hat daher einen zeitlichen Bezug. Zweitens sollten Ressourcen, materielle/immaterielle Güter, wirtschaftliche/ökologische Einheiten usw. geschützt werden, insbesondere wenn sie nicht erneuerbar sind. Drittens sollte der Fortbestand eines Bezugsobjekts kurz- und langfristig gesichert werden [36, 37, 4].

Des Weiteren umfasst Nachhaltigkeit drei Dimensionen: wirtschaftliche, soziale und ökologische Ziele [38]. Nachhaltige Entwicklung erfordert einen gesellschaftlichen

Wandel, und daher spielt die BNE eine zentrale Rolle bei der Erreichung dieses Ziels (Abb. 1) [39, 40]. Das UNESCO Global Action Programme von 2015 bis 2019 [41] verfolgte das Ziel, einen langfristigen systemischen Wandel im Bildungssystem herbeizuführen und BNE von einem Projekt in eine etablierte Struktur zu überführen. Durch BNE soll jedem Einzelnen bewusst werden, dass sein Handeln nicht nur für ihn selbst und sein unmittelbares Umfeld, sondern auch für andere Konsequenzen hat. Jeder kann dazu beitragen, die Welt zu einem besseren Ort zu machen. Diese Denkweise ist entscheidend, um Veränderungen anzustoßen und dringende globale Probleme anzugehen [42–44]. Nach mehreren Jahren erfolgreicher Umsetzung des Globalen Aktionsprogramms der UNESCO zu BNE [45] und der 17 Ziele für nachhaltige Entwicklung (Sustainable Development Goals: SDGs) [38] wird das neue Programm BNE: *Towards achieving the 17 SDGs (ESD for 2030)* im Jahr 2021 [46] gestartet. Dieses neue UNESCO-Programm unterstreicht die Bedeutung von BNE für die Umsetzung der globalen Agenda 2030 für nachhaltige Entwicklung. Die 17 SDGs geben eine bahnbrechende Richtung für die Zukunft unserer Welt vor [47, 4]. Insgesamt haben sich 193 Länder dazu verpflichtet, bis 2030 allen Menschen ein Leben in Würde zu ermöglichen und gleichzeitig den langfristigen Erhalt der natürlichen Ressourcen sicherzustellen [48].

In den vergangenen Jahrzehnten hat BNE in allen Bundesländern Bedeutung in den Lehr- beziehungsweise Bildungsplänen erhalten, jedoch auf unterschiedliche Weise. Zum Teil ist nachhaltige Entwicklung im Schulgesetz verankert, gilt als Leitmotiv oder wird als Bildungs- und Erziehungsauftrag formuliert. In den Vorgaben der Curricula sind zusätzlich wichtige Themenfelder wie der Klimawandel oder der Erhalt der biologischen Vielfalt einbezogen. Gemäß der UN-Agenda 2030 (Nationaler Aktionsplan, 2017 verabschiedet) [4] soll BNE in allen Bereichen des deutschen Bildungssystems verankert werden. Bildung muss es jedem und jeder Einzelnen ermöglichen, die Auswirkungen des eigenen Handelns auf die Welt zu verstehen und verantwortungsvolle Entscheidungen zu treffen. BNE ist damit kein zusätzliches Thema in der Schule, sondern zielt in allen Bereichen auf die Vermittlung eines Handlungsprinzips. [49] Nachhaltigkeit soll dementsprechend ein durchgängiger Orientierungsrahmen für Denken, Lernen und Handeln sein und nicht ein isoliertes Thema. Der Umsetzungsprozess schulischer Nachhaltigkeitsstrategien ist bislang unzureichend entwickelt und empirisch kaum erfasst.

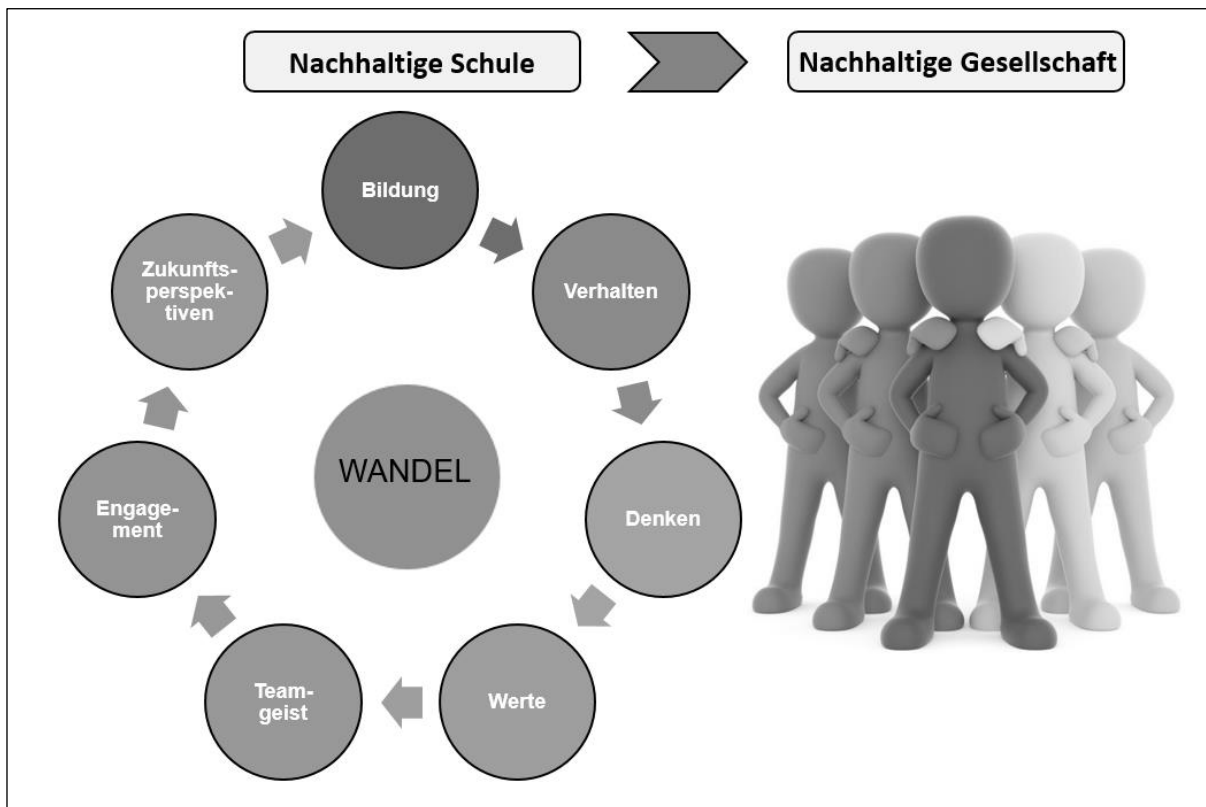


Abbildung 1: Nachhaltige Schule – Nachhaltige Gesellschaft
(selbst erstellt in Anlehnung an [50, 51])

1.3. Optimierungsbedarf, Anpassungserfordernisse und Zielstellung

In Zeiten zunehmender gesundheitlicher Herausforderungen und wachsender Bedeutung nachhaltiger Ernährung wird das Ernährungsangebot in Bildungseinrichtungen zu einem zentralen Thema der öffentlichen Gesundheitspolitik [52]. Die Verfügbarkeit von gesundheitsfördernden und nachhaltigen Lebensmitteln, insbesondere in Schulen ohne reguläres Mittagessen, liegt häufig in der Verantwortung der Bildungseinrichtung selbst, etwa durch den Betrieb eines Kiosks und/oder einer Cafeteria mit ausgewogenen Snacks [53]. Ziel ist es, Schülerinnen und Schülern auch ohne klassisches Mittagessen in den kurzen Pausen bis zur 10. Unterrichtsstunde mit einem schmackhaften und nahrhaften Angebot zu versorgen, das gleichzeitig Bildungsaspekte vermittelt wie Ernährungsbewusstsein und ökologische Verantwortung, besonders wenn keine weiteren Einkaufsquellen im Umkreis vorhanden sind. Für eine Veränderung des Kioskangebots hin zu gesundheitsfördernden und nachhaltigen Angeboten ist die Diskussion mit den verschiedenen Akteuren entscheidend [7, 54]. Im November 2020 forderte das Ministerium für Umwelt und Verbraucherschutz des Saarlandes, die aktuel-

len Qualitätsstandards der Deutschen Gesellschaft für Ernährung in der Schulverpflegung bundesweit verpflichtend zu machen, da sie nicht wie empfohlen eingehalten werden [55]. Ziel dieser Untersuchung (Publikation 1) war es, Daten über den Ernährungszustand und das Ernährungsverhalten an einem typischen Schulkiosk im deutschen Schulsystem zu erheben und bereitzustellen, um den Status quo zu untermauern und eventuelle Zusammenhänge sowie Möglichkeiten zur Verbesserung des Schulkioskangebots in Richtung einer gesünderen Verpflegung zu identifizieren. Nach einer kritischen Analyse der Gründe für die mangelnde Umsetzung der politisch gewollten Standards für gesündere Mahlzeiten mussten eine neue Strategie und Umsetzungskultur entwickelt, umgesetzt und verfolgt werden, um die aktuellen Barrieren und Herausforderungen für ein gesünderes Schulverpflegungsangebot zu überwinden. Zudem sollte ein Konzept zur Einrichtung einer Wohlfühl-Lounge im erweiterten Cafeteria-Bereich entwickelt und umgesetzt werden. Schulen spielen eine Schlüsselrolle als Multiplikatoren bei der Gestaltung einer nachhaltigen Zukunft, da sie einen großen Teil der jungen Erwachsenen prägen und Einfluss auf deren Alltag und weitere Entwicklung haben. In Anbetracht der zahlreichen Nachhaltigkeitskrisen wie Klimawandel, Artenschwund und wachsende soziale Ungerechtigkeit wirkt sich die Schulbildung auf ihr Wissen, ihre Einstellungen, Emotionen und Werte aus und kann ihnen somit helfen, die Zukunft zu gestalten [56, 57]. Das Thema Nachhaltigkeit ist in den Lehrplänen einzelner Fächer weitgehend enthalten; allerdings in geringem Umfang [58]. Verschiedene Ministerien in Deutschland, unter anderem im Saarland [59], ermöglichen es einer Schule, sich auf verschiedenen Ebenen als Schule der Nachhaltigkeit zertifizieren zu lassen.

Ein weiteres Ziel dieser Forschung (Publikation 2) war es, eine umfassende Strategie zu entwickeln sowie geeignete Handlungsansätze zu identifizieren, um bestehende Herausforderungen zu bewältigen, langfristige Veränderungsprozesse zu fördern und Nachhaltigkeitsprinzipien, die in der „Education for Sustainable Development (ESD) 2030“ [4] formuliert sind, dauerhaft im schulischen Alltag zu verankern. Gezielte Maßnahmen und Strategien bzw. BNE-Ziele sind erforderlich, um Schulen bei der Implementierung der ESD-Ziele systematisch zu unterstützen. Beispielhaft wurden zwei Projekte ausgewählt und anhand der Qualitätskriterien des Nationalen Aktionsplans BNE sowie ihrer Einordnung in den Kontext der Agenda 2030 einer kritischen Analyse unterzogen. Zur Förderung aktiven, selbstgesteuerten und kooperativen Lernens

wurde eine quantitative Methode des projektbasierten Lernens angewendet. Zur zielgerichteten Steuerung und Evaluation der Projekte kam die SMART-Methode zum Einsatz, die die fünf Kriterien *spezifisch*, *messbar*, *attraktiv*, *realistisch* und *terminiert* umfasst. Die als relevant identifizierten Projekte wurden anschließend den 17 Zielen für nachhaltige Entwicklung (17 SDGs) in tabellarischer Form zugeordnet. Darüber hinaus wurde ein Kategoriensystem entwickelt, um eine systematische Einordnung und vergleichende Bewertung der Projekte zu ermöglichen.

2. ERGEBNISSE DER FORSCHUNG

2.1. Erreichte Fortschritte

2.1.1. Entwicklung eines qualitativ hochwertigen Schulkioskangebots und einer Wohlfühl-Lounge (Publikation 1)

Ein Schulkiosk mit gesundem Versorgungsangebot ist mehr als nur ein Ort für den Pausensnack. Er spiegelt das Bewusstsein einer Schule für Gesundheit, Ernährung und Verantwortung wider. Durch das Angebot frischer, regionaler und nährstoffreicher Produkte trägt er zur Gesundheitsförderung und zu nachhaltigem Konsum bei. Damit steht er im Einklang mit den Zielen der BNE [60], die Schülerinnen und Schüler dazu befähigen soll, reflektierte Entscheidungen für eine zukunftsfähige Gesellschaft zu treffen. Das Interesse an einem gesunden, integrativen und nachhaltigen Verpflegungsangebot an Schulen nimmt zu. Dies kann dazu beitragen, die vorherrschenden Probleme der Mangelernährung, der Ernährungsunsicherheit und der nicht nachhaltigen Ernährungsgewohnheiten zu verändern. [61–64]

Erhoben wurden das individuelle Ernährungswissen und -verhalten sowie das Einkaufsverhalten in einem typischen Kioskszenario an einem Berufsbildungszentrum. Darauf aufbauend wurde ein Konzept zur Verbesserung des Schulkioskangebots nach dem DGE-Qualitätsstandard der Deutschen Gesellschaft für Ernährung entwickelt. Bei der Umsetzung waren viele Hindernisse und Herausforderungen zu überwinden. Im Zuge dieser Veränderung wurde die Schaffung einer Wohlfühl-Lounge in der Cafeteria als notwendig erachtet und schließlich realisiert (Publikation 1). Bei der Befragung mit einem webbasierten Fragebogen hat sich gezeigt, dass das individuelle Wissen über gesunde Ernährung und das persönliche Ernährungsverhalten einen direkten Einfluss

auf das Einkaufsverhalten von Schülerinnen, Schülern und Lehrpersonal in einem typischen Kioskszenario haben. Ein großer Teil des Schulkioskangebots entsprach nicht den Wünschen der Schulgemeinschaft. Möglichkeiten zur Verbesserung wurden identifiziert (Publikation 1). Die Auswertung des Fragebogens hat gezeigt, dass ernährungsbedingte Erkrankungen bereits bei Schülerinnen und Schülern zunehmend verbreitet sind und mehr als die Hälfte der Befragten (58%) nicht zu Hause frühstücken. Hinzu kommt, dass Schülerinnen und Schüler mit niedrigerem Bildungsniveau im Vergleich zu gymnasialen Schülerinnen und Schülern einen höheren Kaufanteil am Kiosk haben (73% gegenüber 59%) [65].

2.1.2. Strategische Umsetzung von Nachhaltigkeit im Schulkontext (Publikation 2)

Schulen sind nicht nur Bildungsorte, sondern auch Vorbilder für die Gesellschaft. Indem sie nachhaltiges Denken und Handeln in den Alltag integrieren, prägen sie die Werte und Einstellungen der nächsten Generation. Die Förderung gesunder Ernährung kann ein wirkungsvoller Einstieg sein, um Schülerinnen und Schüler für zentrale gesellschaftliche Themen zu sensibilisieren. Sie lernen dabei nicht nur, auf ihre eigene Gesundheit zu achten, sondern setzen sich auch mit Fragen globaler Gerechtigkeit, Nachhaltigkeit und Ressourcenverantwortung auseinander. Aufbauend auf diesem Bewusstsein konnten in der Schule weitere Projekte entwickelt werden, die sich an den 17 Zielen für nachhaltige Entwicklung orientieren. Solche Nachhaltigkeitsprojekte eröffnen den Lernenden vielfältige Möglichkeiten, aktiv an der Gestaltung einer besseren Zukunft mitzuwirken. Die Ziele für nachhaltige Entwicklung bieten einen umfassenden Rahmen für praxisnahe Bildungsarbeit. Schülerinnen und Schüler erfahren dabei, dass ihr Handeln im direkten Umfeld und darüber hinaus Auswirkungen auf globale Zusammenhänge hat. Nachhaltigkeit wird so nicht nur vermittelt, sondern erlebt. Damit leistet die Schule einen entscheidenden Beitrag zur Bildung mündiger, verantwortungsbewusster junger Menschen.

In dieser Arbeit wurde auch der umfassende Prozess zur Umsetzung von Nachhaltigkeit zur Erreichung der Zertifizierung als Schule der Nachhaltigkeit quantitativ analysiert und diskutiert. Es wurde eine Strategie für die Umsetzung der identifizierten Projekte in Anlehnung an die 17 SDGs in Abhängigkeit von der Komplexität entwickelt, d. h. von leicht über mittelschwer bis komplex in der Umsetzung. Exemplarisch wurden zwei Projekte im Hinblick auf die Leitlinien des Nationalen Aktionsplans für BNE und die 17 SDGs der 2030-Agenda ausführlich diskutiert. Als Beispiel für ein *mittelschwer*

umsetzbares Thema kann das Seminarfach „Gesunde Ernährung“ genannt werden und für ein *komplex umsetzbares* Thema das Projekt „Waldklassenzimmer“.

2.1.2.1. Projekt „Gesunde Ernährung“

Das Projekt „Gesunde Ernährung“ (Abb. 2) im Seminarfach förderte die Zusammenarbeit und Kommunikation zwischen den Schülerinnen und Schülern. In kleinen Gruppen mussten sie Aufgaben verteilen, koordinieren und gemeinsam Lösungen finden, was ihre Teamfähigkeit stärkte und ihre Eigeninitiative förderte. Ein wichtiges Ziel des Projekts war es, das Bewusstsein für gesunde Ernährung zu schärfen. Schon beim Einkaufen beschäftigten sich die Schülerinnen und Schüler intensiv mit der Auswahl und Kombination von Zutaten, um ausgewogene und nährstoffreiche Snacks zu kreieren. Dies führte zu einer kritischen Auseinandersetzung mit den eigenen Essgewohnheiten und motivierte viele, gesündere Entscheidungen zu treffen. Am Ende hatten die Schülerinnen und Schüler die Möglichkeit, über ihre Erfahrungen zu reflektieren und Feedback zu geben. Viele äußerten sich positiv über den praktischen Ansatz und betonten, dass sie viel über gesunde Ernährung gelernt hätten. Die Reflexion half ihnen auch, die Bedeutung von Zwischenmahlzeiten für ihre Konzentration und Leistung im Schulalltag besser zu verstehen. Der Kurs hatte das Potenzial, sich langfristig positiv auf ihr Ernährungsverhalten auszuwirken. Indem sie lernten, gesunde und schmackhafte Snacks selbst zuzubereiten, wurden sie ermutigt, in Zukunft bewusste Ernährungsentscheidungen zu treffen und ihre Familien zu inspirieren (Publikation 2).

2.1.2.2. Projekt „Waldklassenzimmer“

Das Projekt „Waldklassenzimmer“ (Abb. 2) hat gezeigt, dass die teilnehmenden Schülerinnen und Schüler durch das Projekt und den direkten Kontakt mit verschiedenen Berufen wie Förster, Zimmerer, Betonbauer usw. einen konkreten Schritt in ihrer Berufsorientierung gemacht haben. Nicht nur ihre Neigungen haben sich im Laufe des Projekts entwickelt, auch ihr Selbstbild hat sich deutlich verändert. Die zuvor häufig angenommene Rolle des orientierungslosen Jugendlichen änderte sich für viele Schülerinnen und Schüler. Viele von ihnen konkretisierten ihre Berufspläne für die Zukunft realistisch. Einige der Lernenden gaben an, dass sie in ihrer beruflichen Zukunft einen der oben genannten Berufe ergreifen möchten und haben bereits Schritte zur aktiven Stellensuche unternommen. Neben der Verbindung von theoretischem und praktischem Wissen an diesem ungewöhnlichen Schulstandort steht bei anderen Projekten

rund um das Waldklassenzimmer vor allem die Vermittlung beruflicher Kompetenzen im Vordergrund. Neben den fachspezifischen Lerninhalten erhalten die Schülerinnen und Schüler auch erste Eindrücke von der beruflichen Praxis der am Projekt beteiligten Gewerke. Durch praktische und sinnliche Erfahrungen können sie erste berufliche Neigungen und Interessen entwickeln und diese in Form von gemeinsamen und individuellen Aufgabenstellungen vertiefen.

Die größte Erkenntnis aus diesem Projekt war, dass die Schülerinnen und Schüler in der ihnen zugewiesenen Rolle als Projektunterstützer und indirekte Baumeister aufgeblüht sind. Sie wechselten von der passiven Schülerinnen- und Schülerrolle, die viele gerne einnehmen, in die aktive Rolle von Handwerkern. Es war auffällig, wie die Schülergruppe durch ihre Beteiligung am Prozess und den hohen Anteil an praktischer Arbeit in ihren Aufgaben aufging und sich frei nach ihren Neigungen auf „außerschulische“ Aktivitäten einließ. Dieses Waldprojekt hat den Schülern gezeigt, dass es möglich ist, Nachhaltigkeit zu leben (Publikation 2). Das Waldklassenzimmer wird in Zukunft ein fester Bestandteil der curricularen und pädagogischen Arbeit sein und damit einen Platz im Stundenplan vieler Klassen und Schulformen einnehmen. Weitere Fächer werden etabliert und Lehrerinnen und Lehrer werden die Möglichkeit haben, das Waldklassenzimmer als methodisch sinnvollen Lernraum für ihre Schülergruppen zu wählen. Die Einführung eines Waldklassenzimmers ist ein kontinuierlicher Prozess, der eine ständige Evaluation und Weiterentwicklung erfordert. Die Schulgemeinschaft sollte den Erfolg des Waldklassenzimmers regelmäßig bewerten, Feedback einholen und Anpassungen vornehmen, um sicherzustellen, dass es den Bedürfnissen der Schülerinnen und Schüler entspricht und langfristig erfolgreich ist. Darüber hinaus sind die Pflege und Instandhaltung des Waldklassenzimmers entscheidend für seinen langfristigen Erfolg. Die Schülerinnen und Schüler sollten lernen, die Verantwortung für die Pflege, Reinigung und Instandhaltung zu teilen (Publikation 2).



Abbildung 2: Erfolgreiche Umsetzung eines qualitativ hochwertigen Schulkioskangebots, einer Wohlfühl-Lounge und eines Waldklassenzimmers (selbst erstellt)

2.1.3. Dynamische Umsetzungskultur

Die entwickelte Strategie und die dynamische Umsetzungskultur halfen dabei, Schritt für Schritt von einem ungesunden zu einem gesünderen Schulangebot zu wechseln. Durch die intensive Auseinandersetzung mit dem Umstellungsverfahren wurde den Schülerinnen und Schülern deutlich, dass die im Lehrplan vermittelten Inhalte zur gesunden Ernährung auch konkret im schulischen Alltag umgesetzt werden können. Besonders diejenigen Schülerinnen und Schüler, die aktiv an der Erstellung des Fragebogens beteiligt waren, fühlten sich in ihrem Engagement wertgeschätzt (Publikation 1). Gerade in der heutigen Zeit ist es von großer Bedeutung, dass Ernährungsempfehlungen nicht nur theoretisch vermittelt, sondern auch praktisch gelebt werden.

Das neue Umsetzungskonzept und die neue Umsetzungskultur führten erfolgreich zur Verbesserung des Schulkioskangebots nach dem Qualitätsstandard der Deutschen Gesellschaft für Ernährung und schließlich zur Schaffung und Etablierung einer Wohlfühl-Lounge. Bezüglich des Schulkioskangebots in der Schule waren die Erkenntnisse wegweisend und ließen den Schluss zu, dass das Kioskangebot um mindestens eine

warme, gesunde und vollwertige Mittagsmahlzeit erweitert werden sollte, damit der Hunger auch bei kurzen Pausen an einem langen Schultag gestillt werden kann. Voraussetzung waren längere Kiosk- und Cafeteria-Öffnungszeiten. Der Kauf frischer und vollwertiger Lebensmittel war vielen Befragten wichtig. Nach einer schrittweisen Umstellungsphase wurden am Kiosk und in der Cafeteria keine ungesunden Produkte mehr verkauft, wenngleich diese Maßnahme mit langfristigen Herausforderungen für den Essensanbieter verbunden war. Das Angebot an gesunden Lebensmitteln entspricht nun dem politisch geforderten Standard für eine gesunde Lebensmittelversorgung an Schulen (Publikation 1).

Die farbenfrohe Wohlfühl-Lounge in dem Cafeteria-Bereich lud dazu ein, in den Freistunden zu verweilen und öfter gesunde Mahlzeiten zu kaufen. Das Wissen, dass es in der Schule gesunde Lebensmittel gibt, könnte auch ungesundes Naschen auf dem Schulweg verhindern, was langfristig zu mehr Kioskeinkäufen führen könnte. Für eine breitere Umsetzung ist es wichtig, die Vision einer „Gesunden Schule“ auf allen Ebenen zu praktizieren und dieses Thema grundsätzlich in das Zertifizierungsprogramm aufzunehmen. Nach einer kritischen Analyse der Gründe für das Fehlen politisch gewollter Standards für gesündere Mahlzeiten an Schulkiosken wurde eine Umsetzkultur vorgestellt, die erfolgreich angewendet wurde, um Barrieren und Herausforderungen durch eine inkrementell-dynamische Konzeptstrategie mit iterativer Zusammenarbeit zwischen den Akteuren Verpflegungsdienstleister, Schulverwaltung, Schulleitung, Lehrpersonal und Schülerinnen und Schülern zu überwinden (Publikation 1). Die Einführung der neuen Schulverpflegung stellt einen bedeutenden Schritt in Richtung Nachhaltigkeit dar. Künftig wird das zentrale Thema Nachhaltigkeit in den Schulen zunehmend alle Bereiche in den Fokus rücken.

Weitere Forschung ist wichtig, um Schulen zu einem umfassenden Nachhaltigkeitskonzept und dessen Umsetzung zu führen, denn Schulen tragen eine pädagogische Verantwortung, den Schülerinnen und Schülern nicht nur Wissen zu vermitteln, sondern auch gesundheitsförderliche Lebensweisen nahezubringen. Das Angebot an einem Schulkiosk sollte diese Verantwortung widerspiegeln und konsequent auf eine gesunde, nachhaltige Ernährung setzen. Dies entspricht auch dem Bildungs- und Erziehungsauftrag im Rahmen der Gesundheitsförderung gemäß dem Präventionsgesetz [66]. Ein gesundes Angebot an Schulkiosken ist keine optionale Maßnahme, sondern eine notwendige Investition in die Gesundheit der nächsten Generation. Der Verzicht auf übermäßig fett- und zuckerreiche Produkte und die konsequente Ausrichtung

auf vollwertige nährstoffreiche Lebensmittel sind wissenschaftlich begründet und praktisch umsetzbar. Damit werden nicht nur die individuellen Gesundheitschancen, die Konzentrationsfähigkeit und die Leistungsfähigkeit der Schülerinnen und Schüler verbessert, sondern auch ein gesellschaftlich wichtiges Zeichen für Prävention und Gesundheitsförderung gesetzt. Gesunde Ernährung in Schulen ist nicht nur eine Frage der richtigen Lebensmittelauswahl, sondern auch ein Spiegelbild größerer gesellschaftlicher Entwicklungen. Wenn Schulkioske zunehmend auf gesunde und nachhaltige Produkte setzen, handelt es sich um Verhältnisprävention und dies zeigt, dass sich das Bewusstsein für verantwortungsvollen Konsum verändert. Eine Schule, die sich mit gesunder Lebensweise auseinandersetzt, stellt zwangsläufig auch andere Fragen: Woher kommen die Produkte, die wir konsumieren? Wie werden sie hergestellt? Und welche Verantwortung tragen wir als Konsumentinnen und Konsumenten? Wer beginnt, sein Essverhalten zu hinterfragen, wird schnell erkennen, dass Nachhaltigkeit in vielen weiteren Bereichen des Schulalltags eine Rolle spielt. Genau hier setzt das Konzept der nachhaltigen Schule an. Es geht nicht mehr nur darum, Schülerinnen und Schülern Wissen zu vermitteln, sondern sie aktiv in den Wandel unserer Gesellschaft einzubeziehen. Eine nachhaltige Schule beschäftigt sich mit ressourcenschonendem Verhalten, sozialen Werten und einer zukunftsfähigen Lebensweise. Neben gesunder Ernährung werden auch Themen wie Energieverbrauch, soziales Miteinander, Müllvermeidung und Mobilität immer wichtiger.

2.1.4. Nachhaltigkeitsprojekte als Schlüssel zu verantwortungsbewusster Bildung

Junge Menschen, die in ihrer Bildungseinrichtung mit mehr Nachhaltigkeit konfrontiert werden, neigen dazu, sich nachhaltiger zu verhalten [56]. Dies wurde in den Projekten deutlich. Zahlreiche Fähigkeiten der Schülerinnen und Schüler wurden durch projektbasiertes Lernen und Entscheidungsfindung, Problemlösung, Zusammenarbeit, Kommunikation, selbstgesteuertes und selbstreguliertes Lernen sowie selbständiges Zeitmanagement verbessert [67–69]. Das transformative Potential der schulischen Bildung unter Berücksichtigung der zugrunde liegenden sozialen Bedingungen wurde als übergeordneter Aspekt von „BNE für 2030“ anerkannt [40].

Nachhaltigkeitsprojekte bieten den Schülerinnen und Schülern die Möglichkeit, sich aktiv mit den 17 Zielen für nachhaltige Entwicklung auseinanderzusetzen und einen positiven Beitrag für ihre Gemeinschaft und darüber hinaus zu leisten. Schulprojekte, die auf die 17 SDGs abzielen, sind daher oft mehrdimensional und tragen dazu bei,

mehrere Ziele gleichzeitig zu erreichen, was die Komplexität und die Verflechtung der Herausforderungen widerspiegelt. Nach der Umsetzung der 17 SDGs in unterschiedlichen Schulbereichen kann eine Schule bei dem Bildungsministerium eine Zertifizierung beantragen. In diesem Prozess sind die Multiplikatoren sehr wichtig, d. h. Lehrkräfte, die sich bereit erklären, den Zertifizierungsprozess intensiv zu begleiten, und Schülerinnen und Schüler, die den Wandel unterstützen. Die Schulen werden im Zertifizierungsprozess durch Unterrichtsmaterialien, entsprechende Fortbildungen, Veranstaltungsprogramme und durch die Zusammenarbeit mit außerschulischen BNE-Experten beraten und finanziell unterstützt. Eine Jury prüft die Bewerbung und die vielfältigen Projekte und Maßnahmen sowie die Planung künftiger Projekte und entscheidet über die Vergabe des Titels „Schule der Nachhaltigkeit“.

Die Hypothese hat sich bestätigt, dass die Entwicklung eines evidenzbasierten Umsetzungsmodells mit Projektmaßnahmen gemäß den 17 Zielen für nachhaltige Entwicklung, die nach geringem, mittlerem und hohem Inhalts- und Organisationsgrad kategorisiert sind, von entscheidender Bedeutung für die Zertifizierung als „Schule der Nachhaltigkeit“ ist (Publikation 2). Der Erfolg von Nachhaltigkeitsprojekten hängt weitgehend vom Engagement der Lehrkräfte und den verfügbaren finanziellen Ressourcen ab [70]. Lehrerinnen und Lehrer, die sich für Nachhaltigkeit begeistern und bereit sind, über den regulären Unterricht hinaus Zeit und Energie zu investieren, können solche Projekte entscheidend vorantreiben [71, 72]. Mangelnde Motivation, mangelndes Engagement, fehlendes Wissen und fehlende Ideen auf Seiten der Lehrkräfte können dazu führen, dass Projekte stagnieren oder sogar scheitern. Fehlt die nötige Begeisterung, werden Projekte oft nur halbherzig umgesetzt oder ganz vernachlässigt. Die Schülerinnen und Schüler spüren diese Zurückhaltung und verlieren das Interesse. So können Nachhaltigkeitsprojekte schnell an Schwung verlieren und in ihrer Wirkung verpuffen. Darüber hinaus kann sich eine solche Haltung auch auf das gesamte Schulklima auswirken und die allgemeine Bereitschaft, sich für nachhaltige Ziele einzusetzen, verringern. Die Unterstützung und Anerkennung engagierter Lehrer, auch durch die Schulleitung, ist daher von großer Bedeutung [73–77]. Eine quantitative Studie hat gezeigt, dass es große Lücken in der Qualifizierung von Lehrkräften im Bereich der Nachhaltigkeit gibt, da zwei Drittel der deutschen Lehrkräfte während ihres Studiums nie und weitere 22% selten mit dem Thema BNE konfrontiert wurden [56]. Viele Lehrer fühlen sich nicht ausreichend vorbereitet, um ihre Schülerinnen und Schüler bei der

Entwicklung der für eine nachhaltigere Zukunft erforderlichen Fähigkeiten zu unterstützen [78]. Nachhaltigkeit sollte einen größeren Stellenwert in der Lehrerausbildung erhalten, damit angehende Lehrkräfte besser auf entsprechende Herausforderungen im Schulalltag vorbereitet sind; dazu bedarf es einer engeren Verzahnung zwischen Universitäten und Schulen [79–81]. Laut einer Umfrage unter Schulleitern [82] sind die größten Herausforderungen bei der Förderung von Nachhaltigkeit und BNE in Schulen der Mangel an Zeit und Personal (72%), die Priorisierung anderer Anforderungen an die Schule (71%), fehlende finanzielle Ressourcen (54%) und eine starke Ausrichtung des Schulalltags auf Prüfungen und Leistungsziele (40%).

Die Schulen sollten Rahmenbedingungen schaffen, die es den Lehrern erleichtern, sich über den Unterricht hinaus an Nachhaltigkeitsprojekten zu beteiligen. Dazu gehören Fortbildungen, die Bereitstellung von Ressourcen und vor allem eine Kultur der Wertschätzung und Unterstützung. Die Zusammenarbeit im Kollegium und der Austausch von Ideen und bewährten Verfahren können ebenfalls dazu beitragen, die Motivation hoch zu halten und Nachhaltigkeitsprojekte erfolgreich umzusetzen [83]. Dies ist sehr wichtig, da die Lehrerausbildung im Bereich BNE als die schlechteste in den meisten Bildungsbereichen bewertet wurde [84]. Schulen, die die 17 Ziele für nachhaltige Entwicklung ernst nehmen, leisten einen Beitrag zur Transformation unserer Gesellschaft. Sie ermutigen junge Menschen, Mitgestalterinnen und Mitgestalter einer lebenswerten Zukunft zu sein – im Kleinen wie im Großen.

2.2. Wissenschaftliche Relevanz

Die wissenschaftliche Relevanz der Forschung zum Thema Schulkiosk (Publikation 1) zeigt sich darin, dass die Umfrage neue Daten und Erkenntnisse darüber lieferte, wie eine typische Lebensmittelversorgung an einer Schule, die nur über einen Kiosk verfügt, verbessert werden kann und wie gesunde Ernährung in der Schulpraxis funktionieren kann. Schulträger und Bildungseinrichtungen könnten dadurch inspiriert und zur Nachahmung animiert werden, sodass dauerhaft nur noch gesundes Essen im Setting Schule angeboten wird. Erkenntnisse, die geteilt werden, sparen Zeit und Ressourcen. Daten aus der Befragung spiegeln ein realistisches Bild der aktuellen Essgewohnheiten der Schulgemeinschaft wider, welches anderen Bildungseinrichtungen als Information zur Verfügung steht. Schule ist Gegenstand der Forschung geworden; damit ist ihre Rolle im Bildungs- und Gesundheitsdiskurs gestärkt.

Die wissenschaftliche Relevanz des Nachhaltigkeitsbeitrags (Publikation 2) liegt darin, dass Schulen einen praxisnahen Einblick in die Bedeutung von Nachhaltigkeit erhalten. Zudem wird eine erweiterbare Plattform vorgestellt, die beispielhaft aufzeigt, welche Projekte im Rahmen der 17 Ziele für nachhaltige Entwicklung (SDGs) realisierbar sind oder bereits umgesetzt wurden. Innovative Ideen können entscheidende Impulse für andere Bildungseinrichtungen liefern und Vielfalt wachsen lassen. Darüber hinaus sollen Schulen ermutigt werden, sich aktiv mit dem Konzept einer „Schule der Nachhaltigkeit“ auseinanderzusetzen, entsprechende Schritte zur Zertifizierung einzuleiten und selbst neue Projekte zu entwickeln. Die Nachhaltigkeitsprojekte zeigen wie Partizipation in der Schule gelingen kann.

Die nach Komplexitätsgraden differenzierte Strategie zur Umsetzung von Projekten im Sinne der SDGs kann und sollte in die Lehrerbildung integriert werden und so die institutionelle Verzahnung von Universität und Schule stärken. Zusätzlich kann das Projekt Bildungsministerien und Bildungseinrichtungen als Inspiration dienen, die Zertifizierung zur „Schule der Nachhaltigkeit“ verpflichtend einzuführen, damit die Ziele bis 2030 annähernd erreicht werden.

2.3. Perspektiven für Forschung und Praxis

Die Vision einer „Gesunden Schule“ umfasst alle Ebenen des schulischen Lebens und trägt durch ihren Vorbildcharakter maßgeblich zur Förderung von Gesundheit, Nachhaltigkeit und Verantwortungsbewusstsein bei. Um diesen Wandel wirksam zu gestalten, ist es erforderlich, das Thema „Gesunde Schule“ fest im Zertifizierungsprogramm von Bildungseinrichtungen zu verankern – denn strukturelle Veränderungen müssen nicht nur initiiert, sondern auch gelebt werden.

Darüber hinaus bedarf es weiterer wissenschaftlicher Forschung, um Schulen auf dem Weg zu einem umfassenden Nachhaltigkeitskonzept zu unterstützen und evidenzbasierte Strategien zu entwickeln. Eine zentrale Rolle spielt dabei die flächendeckende Umsetzung des DGE-Qualitätsstandards, wie von der DGE-Präsidentin Prof. Renner gefordert. Im internationalen Kontext verweist die EAT-Lancet-Kommission mit der im Oktober 2025 vorgestellten *Planetary Health Diet 2.0* (PHD 2.0) auf die Dringlichkeit einer grundlegenden Transformation der globalen Lebensmittelsysteme [85]. Diese Entwicklungen verdeutlichen die Notwendigkeit, Gesundheitsförderung, Ernährungsbildung und Nachhaltigkeit integrativ in schulische Strukturen zu verankern.

Lehrerinnen und Lehrer spielen eine unverzichtbare Rolle bei der Vermittlung von Konzepten der nachhaltigen Entwicklung und deren Umsetzung in die Praxis. Ihre Fähigkeit, komplexe Sachverhalte verständlich zu erklären und die Relevanz nachhaltiger Entwicklung im Alltag aufzuzeigen, ist entscheidend für den Lernerfolg. Es geht darum, theoretisches Wissen zu vermitteln, praktische Fähigkeiten zu fördern und ein tiefes Verständnis für die Herausforderungen und Lösungen im Bereich der Nachhaltigkeit zu entwickeln. Das Engagement der Lehrkräfte ist ein Schlüsselfaktor. Lehrerinnen und Lehrer, die sich mit Leidenschaft und Engagement für Nachhaltigkeit einsetzen, können ihre Schülerinnen und Schüler inspirieren und motivieren, sich aktiv einzubringen. Sie fungieren als Vorbilder und Multiplikatoren, die zeigen, wie nachhaltiges Handeln in der Praxis aussehen kann und welche positiven Auswirkungen es auf Umwelt und Gesellschaft hat. Eine lehrplanmäßige Umwelterziehung in der Schule spielt eine wichtige Rolle bei der Förderung des Rechts auf eine nachhaltige Umwelt [86].

Darüber hinaus ist die Kompetenz der Lehrkräfte im Bereich der Nachhaltigkeit entscheidend. Durch eine fundierte Ausbildung und regelmäßige Fortbildung sind sie in der Lage, den Schülerinnen und Schülern die neuesten wissenschaftlichen Erkenntnisse zu vermitteln. Dadurch sind sie befähigt, qualitativ hochwertige Bildungsangebote zu gestalten, die sowohl die Wissensvermittlung als auch die Entwicklung von Fähigkeiten und Einstellungen im Sinne einer nachhaltigen Entwicklung fördern. Nur durch die aktive Beteiligung und kontinuierliche Fortbildung der Lehrkräfte können Nachhaltigkeitsprojekte erfolgreich umgesetzt und nachhaltig in der Schulkultur verankert werden. Dies erfordert nicht nur individuelles Engagement und Organisationstalent, sondern auch die Unterstützung durch die Schulleitung und die Bildungspolitik, um die entsprechenden Rahmenbedingungen und Ressourcen bereitzustellen [87]. Des Weiteren wäre eine grundlegende Überarbeitung wissenschaftlicher Lehrbücher wünschenswert, bei der das Thema Nachhaltigkeit stärker integriert wird. Ergänzend dazu sollten digitale Lehrmaterialien (E-Bücher) auf Basis von BNE gefördert werden, da deren Merkmale – etwa leichte Zugänglichkeit, Suchfunktionen und interaktive Elemente – das Engagement der Schülerinnen und Schüler erhöhen können [88].

Empirische Studien spielen eine zentrale Rolle dabei, zu verstehen, wie Schulen ihren Auftrag der BNE umsetzen und welche Unterstützung sie dafür benötigen. Sie ermöglichen es, die Verankerung von Nachhaltigkeit in Lehrplänen, Projekten und schulischen Strukturen messbar zu machen und dadurch die Wirksamkeit bildungspoliti-

scher Maßnahmen zu überprüfen. Darüber hinaus kann Forschung didaktische Modelle sowie Beispiele guter Praxis identifizieren und Lehrkräften zur Verfügung stellen, um die Vermittlung nachhaltiger Inhalte zu fördern. Schließlich sind Studien notwendig, um zu erfassen, wie Bildung nachhaltige Werte, Einstellungen und Verhaltensweisen stärkt und in welchem Maße Schulen als Lernorte der Zukunft zur Bewältigung globaler Herausforderungen beitragen können.

2.4. Limitierungen

Die erste Studie (Publikation 1) wies mehrere relevante Einschränkungen auf, die die Aussagekraft und Übertragbarkeit der Ergebnisse potenziell beeinträchtigten. Die Vorgaben des Ministeriums hatten einen erheblichen Einfluss auf die Gestaltung und Durchführung des webbasierten Fragebogens. Die Rahmenbedingungen schränkten die methodische Flexibilität der Untersuchung erheblich ein. So war die Beantwortung der einzelnen Fragen an die Freiwilligkeit der Teilnehmenden gebunden, wobei gleichzeitig die Anonymität gewahrt werden musste. Zudem war die Teilnahme auf volljährige Personen beschränkt, und die Befragung durfte ausschließlich in der Freizeit, nicht jedoch im Unterricht, durchgeführt werden. Mit der Vorgabe eines kurzen Zeitrahmens für die Durchführung entstand ein weiteres Problem, konkret die geringe Rücklaufquote des Fragebogens. Diese führte zu einer eingeschränkten Datenbasis und minderte somit die Repräsentativität der Stichprobe. Dadurch bestand die Gefahr einer systematischen Verzerrung der Ergebnisse, da bestimmte Personengruppen – etwa besonders interessierte oder weniger interessierte Teilnehmende – überproportional vertreten sein konnten. Als zusätzlicher begrenzender Faktor erwies sich die Motivation der Beteiligten. Sowohl Schülerinnen und Schüler als auch Lehrkräfte zeigten teilweise ein geringes Interesse am Thema Ernährung. Diese geringe intrinsische Motivation wirkte sich vermutlich negativ auf die Qualität der erhobenen Daten sowie auf die Umsetzung von Ernährungsprojekten im schulischen Alltag aus. Ergänzend dazu zeigte sich auch beim Essensanbieter eine schwankende Motivation in Bezug auf die Einhaltung der DGE-Qualitätsstandards. Gegen Ende der Studie nahm die Bereitschaft zur Umsetzung jedoch zu, was sich insgesamt positiv auf die Einhaltung der Qualitätskriterien und damit auf die Aussagekraft der Ergebnisse auswirkte.

Auch die zweite Studie (Publikation 2) war mit verschiedenen Limitierungen konfrontiert, die vor allem auf strukturelle und institutionelle Rahmenbedingungen zurückzu-

führen sind. Eine zentrale Herausforderung bestand darin, dass das Thema Nachhaltigkeit bei einigen Lehrkräften bislang nur begrenzt verankert war, sodass Projekte zu diesem Themenfeld nur eingeschränkt unterstützt werden konnten. Hinzu kommt die geringe Integration des Themas Nachhaltigkeit in den Lehrplänen. Ohne klare curriculare Vorgaben fehlt den Schulen ein verbindlicher Rahmen, um nachhaltigkeitsbezogene Inhalte systematisch in den Unterricht einzubinden. Viele Lehrkräfte empfinden es zudem als herausfordernd, eigenständig Projekte zu entwickeln und umzusetzen, zumal gezielte Weiterbildungsmöglichkeiten in diesem Bereich noch begrenzt sind. Auch die finanziellen Ressourcen sind häufig eingeschränkt, wodurch Materialien oder externe Expertinnen und Experten nur begrenzt genutzt werden können. Schließlich konkurriert Nachhaltigkeit in vielen Schulen mit anderen als dringlicher wahrgenommenen Anforderungen, sodass entsprechende Projekte oft nicht die notwendige Aufmerksamkeit erhalten, um dauerhaft etabliert zu werden.

LITERATUR

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3. PUBLIKATION 1

Incremental implementation concept for healthy eating habits in German school with kiosk

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Incremental implementation concept for healthy eating habits in German school with kiosk

Concept for
healthy eating
habits

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Abstract

Purpose – School kiosk offerings play a crucial role in the dietary behavior of students. The importance of healthy meals in schools is emphasized again and again, but there is a lack of practical implementation and literature data on kiosk offers and acceptance. This study aimed to analyze the reasons and improve the situation.

Design/methodology/approach – Individual nutrition knowledge and behavior as well as purchasing behavior at a typical kiosk scenario at schools were collected. Based on the outcome, a concept for improving the school kiosk offerings according to the quality standard of the German Nutrition Society was developed. Many obstacles and challenges had to be overcome in the transition to healthier offerings and their implementation. In the course of these changes, the creation of a new feel-good cafeteria lounge was deemed necessary and finally realized.

Findings – A large percentage of the school kiosk offerings did not meet the desires of the school community. Opportunities to improve the school kiosk service were identified. The skillful planning of structural changes towards healthy food offers and warm meals on two weekdays made it possible to implement the official nutrition standards for healthier meals at school kiosks, despite long-term challenges for food providers.

Originality/value – After a critical analysis of the reasons for the lack of politically desired standards for healthier meals at school kiosks, a new implementation culture is presented and was successfully applied to overcome barriers and challenges through an incremental-dynamic concept strategy with iterative cooperation between the actors of food service providers, school administration, school management, teachers and students.

Keywords Implementation culture, Official nutrition standard for healthier meals, Healthy school kiosk offerings, Feel-good cafeteria lounge

Paper type Research paper

Erratum: It has come to the attention of the publisher that the article, Bauer, M. and Morlock, G.E. (2024), "Incremental implementation concept for healthy eating habits in German school with kiosk", *Nutrition & Food Science*, Vol. 54 No. 6, pp. 1031-1046. <https://doi.org/10.1108/NFS-12-2023-0302>, incorrectly listed the affiliation of Gertrud E. Morlock. This error occurred during the production process. The affiliation has been corrected in the online version of the article to Institute of Nutritional Science, Justus Liebig University Giessen, Giessen, Germany. The publisher sincerely apologises for any inconvenience caused.

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Introduction

Students and teachers consume a significant portion of their daily energy intake in the school environment (Pankuweit, 2020; World Health Organization, 1998). A nutritionally balanced diet is critical for optimizing development, health status and academic performance [German Nutrition Society (DGE), 2021a; Critch, 2020]. However, the foods and beverages consumed at school are often high in energy and low in nutrients (O'Halloran *et al.*, 2020; Bardin *et al.*, 2020). An Australian study reported that, on average, 37% of the total daily energy intake is consumed at school. Energy-dense foods and beverages were found to contribute more to energy intake at school than outside of school (Toumpakari *et al.*, 2019). The Ottawa Charter first coined the setting approach as a concept of health promotion in 1986, and it served as the basis of the World Health Organization (WHO) Healthy Cities Project (Eriksson and Lindström, 2008). An example of a WHO intervention is the health-promoting school setting (World Health Organization, 1998; Pankuweit, 2020).

German vocational training centers usually house many different types of schools with different degrees (Information S1). Topics on healthy nutrition are established in numerous school types. Especially in the health subject of the upper secondary school, in-depth contents on healthy balanced nutrition and the recommendations of the German Nutrition Society are taught (Ministry of Education and Culture, 2021b). Nutrition knowledge is the ability to understand healthy eating concepts so that eating behaviors and habits can be influenced (Worsley, 2002; Rosi *et al.*, 2020). The German Federal Research Institute of Nutrition and Food (Max Rubner Institute) defines nutritional behavior as follows:

The totality of

“planned, spontaneous or habitual actions of individuals or social groups with which food is procured, prepared, consumed and post-processed”.

In this context, nutritional behavior encompasses

“both influencing factors and effects from the dimensions of health, environment, society and economy along the entire food product chain” (Federal Research Centre for Nutrition and Food, 2021).

A healthy catering offer at school is a promising approach to introduce the school community to a health-promoting diet and to contribute to the prevention of civilization diseases (Weichselbaum and Buttriss, 2014; Kersting, 2016; Guthke, 2022; Arens-Azevedo, 2016). School catering has changed in recent years, and many countries have standards for school catering, although there is still a lot of room for improvement (Weichselbaum and Buttriss, 2014; Lalli *et al.*, 2024). German vocational training centers offer no lunch but usually have a kiosk or cafeteria run by an external operator. The term kiosk refers to a form of retail business that offers a small range and depth of goods for short-term needs, occasionally in conjunction with a drinks bar. In schools, it is usually a room with a small sales counter that is open to the schoolyard with a shutter. There is no seating available as given for a cafeteria. So far, the recommendations of the German Nutrition Society have not been implemented there. Offering sweet, salty snacks, candy bars and sugary drinks for breakfast and/or as a snack in schools is often controversial, and binding policies for quality assurance in school kiosks are needed. For a change of the kiosk offer towards health-promoting and sustainable offerings the discussion with the different stakeholders is crucial [German Nutrition Society (DGE), 2021a]. In November 2020, the Ministry for the Environment and Consumer Protection called for the latest quality standard of the German Nutrition Society to be made mandatory in school catering nationwide, as they are not followed as recommended (Ministry of Environmental Protection and Consumer Protection, 2021).

The aim of this research was to collect and provide data on the nutrition status and behavior at a typical school kiosk in the German school system to substantiate the status quo and to identify any correlations or opportunities to improve school kiosk services

towards a healthier food supply. After critical analysis of the reasons for the lack of the translation and implementation of the politically desired standards for healthier meals, a new strategy and implementation culture had to be developed, realized and followed to overcome current barriers and challenges towards healthier school food offerings.

Methods

Creation of questionnaire, structure and layout (quantitative method)

As part of a school project in the subject health, students at the German vocational training center (Berufsbildungszentrum) observed that the topic of healthy nutrition including the quality standard of the German Nutrition Society is taught in detail in class, but that the offer at the school kiosk does not meet this standard. Potential items of a standardized questionnaire on nutrition topics were designed and discussed in a group of 16 students in grade 12 at the upper secondary school. An online questionnaire was targeted. As almost all students have mobile phones, there was no bias for attracting only a certain group of people, especially those with access to the internet and technology. Another bias could arise from the fact that students who are willing to participate in online surveys have certain characteristics that distinguish them from people who do not participate. In addition to the reminder email to take part in the online survey, all teachers also asked the pupils to take part again. This increased motivation and thus counteracted any bias. Online questionnaires often offer predefined answer options that may not capture all the nuances or perspectives of a topic. This can lead to superficial or inaccurate answers, especially for complex topics. Navigation through the questionnaire was designed to be very simple so that no errors could occur. The final questionnaire was programmed online as a Web-based survey (Google Docs, Google, Mountain View, California, USA). The basic format of the questionnaire was predetermined, whereas design options (illustration, color and font) and question types could be customized. An online questionnaire was an attractive means of collecting data, and the evaluation of the digital data could be handled efficiently. The test subjects of a first pretest were the aforementioned students, using the think aloud technique according to good scientific practice (Buschle *et al.*, 2021; Aschemann-Pilshofer, 2001). The development of the questionnaire and first test took place from January to March 2021. The questionnaire was adapted and after an elaborate approval process by the Ministry of Education and Culture, permission was granted to conduct the survey. The structure of the online questionnaire consisted of an introductory text requesting to answer completely and truthfully, stating that this survey is anonymous and voluntary and that it will take about 10 min (Questionnaire S1). The first question on data protection was mandatory as specified by the Ministry of Education and Culture (Ministry of Education and Culture, 2021a). All other 41 questions were voluntary to answer. The core aspect in finding the proper questions was to capture the status quo in the best possible way through questions phrased by the expertise of teachers and students in the field of health studies in several meetings. All aspects are ultimately interconnected, some of them in more subtle ways. In addition to general questions about the person (student/school type or teacher, age, gender, weight, height, diet-related illness, sports), questions were asked about nutrition knowledge and dietary behavior at home and at school, as well as purchasing behavior at the kiosk. The questionnaire consisted of 42 questions of which three were open-ended (simple and numerical answers) and the remaining questions were closed-ended. The closed questions were partly multiple-choice questions, which allowed multiple answers, or partly single choice questions, which allowed only one answer among alternatives. Furthermore, there were closed questions, where only one answer with a verbalized scale or endpoint verbalized scale was allowed.

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Subjects, administration, questionnaire response rate and evaluation tool

The link to the Web-based questionnaire form was sent in an invitation email including information on June 02, 2021 to 1319 subjects out of a total of 1,734 persons in the school community. A cohort of 1,199 adult students, of whom 350 were female and 849 male, and 120 teachers, of whom 61 were female and 59 male, received the invitation to participate. Due to the recommendation of the Ministry of Education and Culture regarding data protection, only the adult students were surveyed. The release period for processing the questionnaire was 6 days. The questionnaire could not be processed in class, but had to be answered in free time, as decided by the Ministry of Education and Culture. One reminder email was sent on June 05, 2021. The answers were returned anonymously after being sent by the subjects; it was not possible to track them. After closing participation, 204 subjects including 44 teachers were registered. The questionnaire was completed by students from different types of schools (Information S1): students of upper secondary school 26.6%, students of specialized upper secondary school 19.2%, students of vocational school – intermediate secondary education 10.8%, students of vocational school – training occupation degree 21.2%, students of training preparation program 0.5% and by teachers (21.7%). The overall response rate was 16%. The data were evaluated and the results of the individual questions of the questionnaire were determined as percentages and presented as pie charts or bar charts (Microsoft Excel 2016, Microsoft Corporation, Redmond, Washington, USA).

Iterative-dynamic improvement strategy and concept development

Based on the results of the questionnaire, barriers and opportunities were identified. A strategy for an improvement of the food offer was developed step by step. In the planning phase, the search for optimization potential with regard to the kiosk offer and the kiosk presentation took place. Sound possibilities for improvement were formulated by stakeholders in numerous discussions and meetings. The school administration, the kiosk operator and the school representative were involved. The school administration was informed. An incremental implementation of the food offer followed numerous discussions and meetings with respective actors (Information S2). A special kiosk offer was planned as attraction on the *Healthy Eating Day* (Information S3). The space for establishing the lounge was made available in the extended cafeteria area (Information S4). A room concept including a time schedule for the implementation was prepared, offers from furniture companies were obtained. Coordination on design selection, color selection and prices took place together with the school administration. The concept for new lunch offers was established and implemented (Information S5).

Results

The developed questionnaire (Questionnaire S1) was distributed, filled out and evaluated to find out the nutrition knowledge and behavior of individual students (≥ 18 years) and teachers and the use and acceptance of the school kiosk. Feedback was given by 59% female and 41% male students and teachers, and 0.5% reported diverse gender (Questionnaire S2). Most were students (78%) but 22% were teachers. In addition, five different types of schools were represented (Information S1). Almost a third of the respondents (29%, 60 out of 204) had a BMI ≥ 25 . Overweight (BMI ≥ 25 and < 30) was given for 52 respondents. A total of 36 students and 16 teachers were overweight. Obesity or adiposity (BMI ≥ 30) (Hemmelmann *et al.*, 2010) was given for eight individuals (four men and four women).

Nutritional knowledge

The classification of the nutritional knowledge and habits was interesting, with most of the respondents seeing their nutritional habits in the healthy to very healthy range, and 44% of the respondents indicated very good basic knowledge. Many subjects received their knowledge on the subject of nutrition from home, *i.e.* from the family environment and nutritional habits at home. The internet had a strong influence on knowledge formation. Knowledge resulting from school lessons was given by only 75 out of 204 subjects (37%). The majority of the school community (82%) was familiar with the three-dimensional nutrition pyramid of the German Nutrition Society [German Nutrition Society (DGE), 2021b].

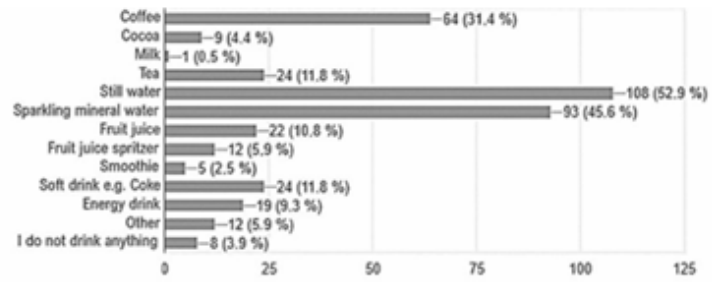
About one third of the subjects (30%) were not interested in food ingredient claims and about the same number (31%) rarely or never looked at the quality or organic seals on food packaging. It was interesting that the school community was more likely to look for foods to be low in sugar (53%) than in fat (39%). Buying fresh products was important to the majority of respondents (83%), as is buying whole foods (84%). Seasoning with herbs and less salt when preparing food meant a lot to many participants (58%), but almost half (42%) did not value it. Mixed diets (29%), whole foods (24%), heavily meat-based mixed diets (20%) were the predominant diets with a total of 73%. Strictly plant-based mixed diets (13%), vegetarian (8%) and vegan (2%) diets made up a smaller proportion.

Nutritional habits

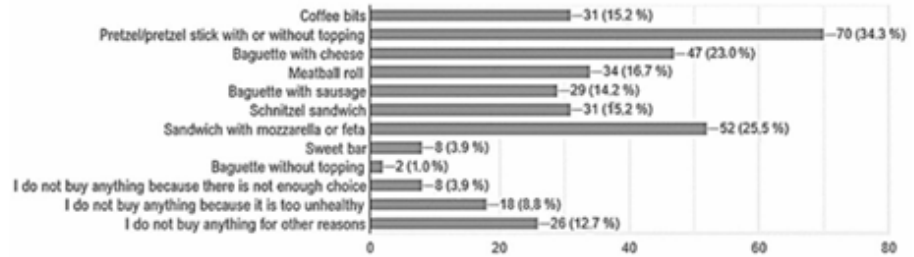
The majority of the school community had classes longer than 12:30 on many days, and half of the respondents brought their lunch to school for the entire school day. This information is available in the timetables of the individual school types and at the Ministry of Education and Culture. During the first recess, most students and teachers (61%) had their first school meal, but 20% did not eat at school at all, no matter how long the class last. Once a day, at least 69% of students and teachers ate a warm meal, taken at lunch or dinner. Ready-made products such as frozen pizza, pasta or rice ready meals, fish sticks, canned meals were popular and consumed by 30% of the respondents frequently per week and by 29% several times per month. A quarter of the school community did not exercise and 28% exercised only once a week. Maintaining weight was important for many participants (67%). For more than half of the respondents, breakfast at home was unimportant and 11% of the respondents drank nothing in the morning.

Coffee and water were popular breakfast drinks [Figure 1(a)]. Coffee was favored by 64 of the 204 respondents (31%). In the morning, 36% of the subjects consumed sweet drinks such as soft drinks (coke and others), smoothies, energy drinks and fruit juices. The collected data on the beverage consumption of the respondents at school highlighted that sweet beverages were popular thirst quenchers apart from water and coffee. Sales of beverages at the kiosk were low, with 73% of respondents stating that they never bought beverages from the kiosk. One reason could be that students and teachers get for free tap water and mineral water from water dispensers.

In a spontaneous virtual decision to shop at the kiosk with the current supply in mind [Figure 1(b)], approximately one-third of the respondents (34%) would choose pretzel or pretzel stick with or without toppings as a snack, followed by sandwich with mozzarella or feta and baguette with cheese. A total of 25% respondents did not want to buy anything from the kiosk. The offer was not attractive, too unhealthy or they did not specify a reason. When asked directly how often students and teachers shopped at the kiosk, the results showed that 42% never shopped at the kiosk, while 44% shopped once or twice a week.



(a)



(b)

Figure 1.
Types and share of
beverage
consumption at
school as well as food
offered at the kiosk

Notes: (a) and possible purchase decisions of the respondents; (b) multiple responses were possible)

Source: Authors' own creation

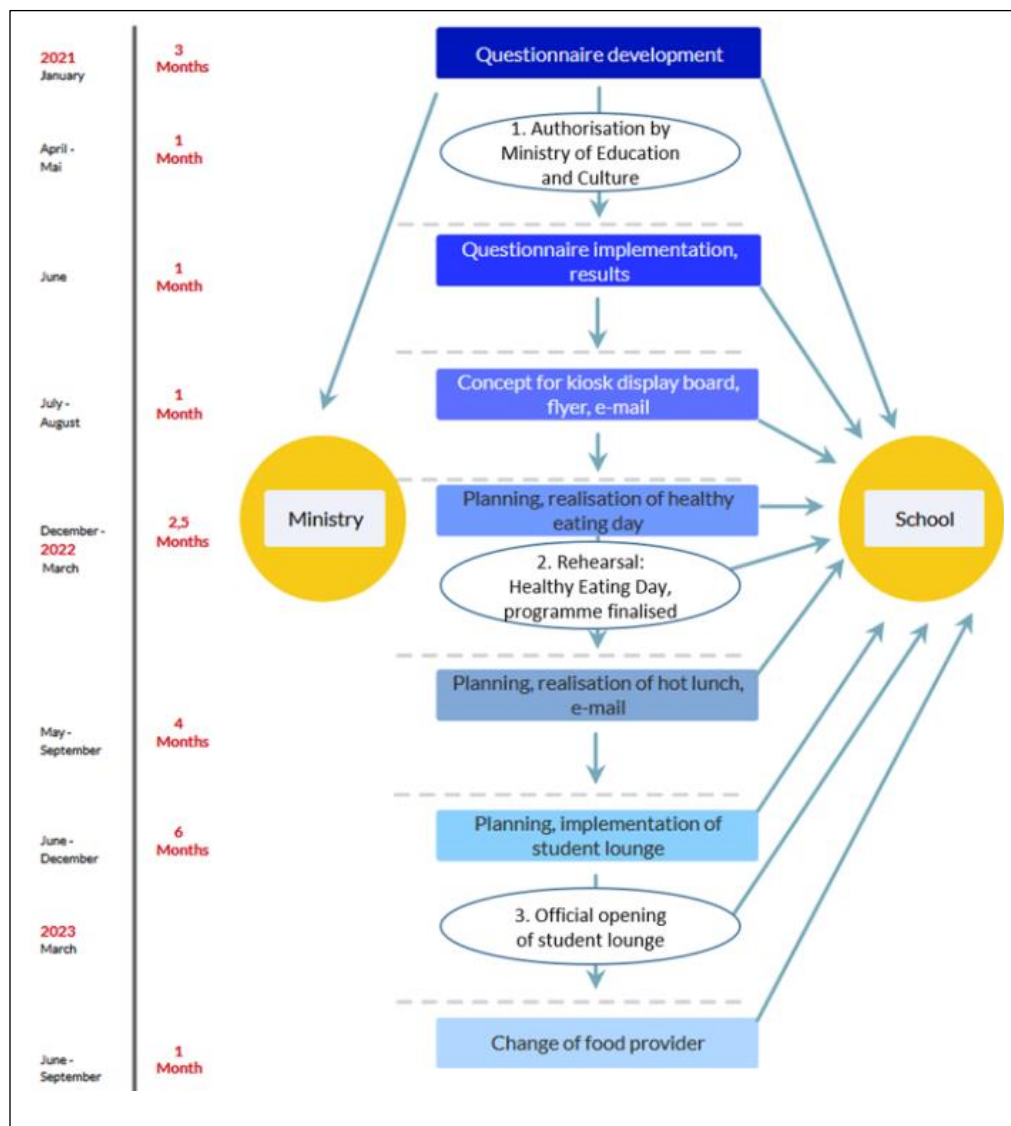
During the entire school day, 79% of the school community drank less than 1 L (26% up to 250 mL, 31% up to 500 mL, 18% up to 750 mL and only 21% more than 1 L).

Opening hours and assortment

More than 50% of the school community are in favor of a kiosk opening time from 7:15 a.m. until the last lesson and 46% are willing to spend €3–5 per day. A regional and seasonal product offer is desired by 64% of the school community, but for 52% of the school community these products do not necessarily have to be organic. If the food offer were to change, the juicy whole meal wrap (60%) would be the favorite, followed by vegetarian whole meal baguette and fresh fruit offer. The issue of sustainability and fair trade is important to over 60% of respondents. On the basis of these new insights into the preferences, the school administration has set certain requirements for the food service provider to ensure that students have the choice to eat healthy and affordable meals. The minimum of 30% healthy offerings should include halal, vegetarian options and whole grain products and be based on the quality standard of the German Nutrition Society.

Translation toward healthy food supply and more sustainability

An incremental-dynamic concept was developed and applied (Figure 2) based on the questionnaire feedback. After several rounds of talks with the food supplier, it was agreed to start with the healthy range and gradually expand it. Due to the corona pandemic,



Source: Authors' own creation

Figure 2. Overview of the implementation culture and incremental-dynamic concept strategy with iterative cooperation between the actors of food service providers, school administration, school management, teachers and students

implementation started slowly at the very beginning of the new school year. It was not until September 2021 that the entire school community was informed about the new breakfast and snack concept by email from the school management. This email also informed about the newly created healthy warm meal and beverage offer from 12:00 to 13:30 on two days per week (Information S2).

For sustainability, the sale of disposable cups was discontinued and the use of reusable cups was made mandatory for purchase or loan for a fee of €2. A special kiosk offer was performed as attraction on the *Healthy Eating Day* (Information S3). A new display case refrigerator in the kiosk area offered a view of various treats in jars such as fruit, yoghurt, muesli as well as wraps and salads. The installation of the lounge area was successfully realized within 6 months (Figure 3, Information S4). In July 2022, the future lunch offer (Figure 4, Information S5) was discussed and

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Figure 3.
Room space in front
of the cafeteria before
and after the
successful
implementation of the
new cafeteria lounge
area



Source: Authors' own creation

determined in a student council meeting. The outcome and its realization were discussed with the food provider. The menu plan with an explanation of the voucher system (meal vouchers are always purchased the day before) was published on the school homepage. The start date was set for the beginning of the new school year in September 2023.

Discussion

Surveys or other literature of nutrition knowledge and dietary behaviors of students (aged over 18 years) and teachers in the context of school kiosks and its food offerings could not be identified, although there are numerous studies on adolescents focusing on dietary habits (Kuchling, 2020), on breakfast (Hopkins *et al.*, 2017), on nutrition and physical activity or on nutrition and school performance (Bödecker, 2011; Overby and Høigaard, 2012; Hoyland *et al.*, 2009; Critch, 2020). Therefore, this survey provided new data and insights on how to improve food provision in schools that only have one school kiosk. The most important official standard in Germany is the three-dimensional nutrition pyramid of the German Nutrition Society [German Nutrition Society (DGE), 2021b], which was used as reference for healthy food. Sustainability has a high priority in this standard. For example, it supports organic farming which is a resource-saving and environmentally friendly form of farming that is based on the principle of sustainability.

Awareness on healthy food

The data collected in this survey showed that among subjects with a high level of nutritional knowledge, the spectrum of dietary habits ranges from unhealthy to very healthy. It means that nutritional knowledge does not protect against wrong eating habits. This has also been found in other studies (Diehl, 2000) and is underlined by the fact that 82% of respondents know the food pyramid, but many do not live accordingly. It is interesting to note that respondents who state that they have little or no knowledge of nutrition are in the middle of



Source: Authors' own creation

Figure 4.
Examples of the
newly implemented
warm meal kiosk
offerings

the scale (Questionnaire S2, question 2) between unhealthy and very healthy. Respondents with a diet-related illness have good to very good eating habits. Checking ingredient information on food packaging is very important for respondents with very healthy and mainly healthy eating habits (73%). Out of 55 students and teachers who follow a very healthy to predominantly healthy diet, 31 respondents pay attention to a quality or organic seal when buying food. It means that for more than half of these respondents, seals are an important purchase criterion. An American study shows that observing the organic seal has a direct effect on increased consumption of organic foods (Gaylord *et al.*, 2020). Among the respondents who have few healthy eating habits, 51% say they look for the organic labels when buying food.

The fat content of a food is an important issue for respondents who eat a very healthy to predominantly healthy diet, with 79% of them paying attention to the fat content when

purchasing. However, for these respondents the sugar content of a food is even slightly more important than the fat content; 81% check the sugar information on the food packaging when shopping. Since nearly half (47%) of students and teachers overall do not pay attention to low sugar content, it would be necessary to reduce the supply of sweet foods at kiosks and declare the sugar content accordingly or eliminate the supply altogether. A study from Singapore showed that effective labeling of the high sugar content of a product can reduce the demand for foods with high sugar content (Ang *et al.*, 2019).

More than half of the respondents attach importance to seasoning more with herbs than salt. Many respondents who do not attach any importance to this still rate their eating habits relatively well. One study found that school lunches usually contain excessive amounts of salt. Bread, in particular, has a high salt content to which students have become accustomed and therefore perceive it as neither salty nor bland (Viegas *et al.*, 2015). As the civilization disease high blood pressure is closely related to salt consumption, the delivery service for schools should strive for tasty, healthy and low-salt alternatives (Viegas *et al.*, 2015).

Awareness on adequate hydration and healthy beverages

Most of the studied school community (79%) drank less than 1 L per school day. Around a tenth (11%) did not drink anything in the morning. Considering that 89% of students and teachers have classes longer than 12:30, the drinking percentage should be higher. Fluid requirement depend on various factors, *e.g.* age, gender, body size, activity level, ambient temperature and state of health. Adequate hydration is a crucial factor for optimal cognitive performance, and water and unsweetened herbal and fruit teas are particularly suitable as thirst quenchers (Kuchling, 2020). However, the collected data showed that sweet beverages were popular thirst quenchers at school, apart from water and coffee. Numerous prospective cohort studies have demonstrated a positive association between sugar-sweetened beverages and weight gain and the risk of developing type 2 diabetes and coronary heart disease. (Malik and Hu, 2019) The WHO states that the number of people affected by obesity worldwide has tripled since 1975. Among the 1.9 billion overweight adults (body mass index, BMI ≥ 25) older than 18, 680 million were obese (BMI ≥ 30) [World Health Organization (WHO), 2021; Okorodudu *et al.*, 2010]. Fifty-two of the respondents were overweight, making them part of the 1.9 billion overweight adults worldwide. The overweight students came from all types of schools, with a higher proportion in vocational schools than in high schools. The proportion of teachers accounts for three individuals. Half of the obese respondents indicate that they have a diet-related illness, and most individuals with a BMI ≥ 30 , mark that their dietary habits are in the average healthy range. The obese respondents further indicate that they eat a mixed diet, a diet heavy in meat or a whole food diet. The survey revealed that more than half of the aforementioned individuals does not watch their weight. Similar results were found for individuals with obesity (BMI ≥ 25 and < 30).

Lack in breakfast highlights importance of healthy school food offerings

All respondents confirmed that they eat a warm meal (lunch or dinner) at least once per day. Breakfast at home was unimportant for more than half of the study participants. A positive relationship between regular healthy breakfast and mental health, as well as reduced stress and reduced presence of depression is described (Hoyland *et al.*, 2009; Smith, 2002). Numerous studies showed that a regular, balanced and nutritious breakfast followed by snacks improves general performance and also school performance, resulting in a positive progression of the personal performance curve. Furthermore, it has been shown that students who do not eat breakfast are often less able to pay attention and have a poor short-term memory (Bödecker, 2011; Overby and Hoigaard, 2012). A study of 188 students in four

experimental classes found significant improvement in mental performance due to improved breakfast quality (Eissing, 2011). A 2019 study found that eating breakfast at home in the morning is more effective in boosting mental performance than eating breakfast at school (Zipp and Eissing, 2019). However, as the percentage of students who eat breakfast at home decreases with increasing age, an increase in performance could be measured with selected healthy foods offered as breakfast at school (Zipp and Eissing, 2019). Other studies have found that students who do not eat breakfast or eat an incomplete breakfast compensate for their hunger by eating unhealthy products, which are often purchased in the school cafeteria or kiosk (Garrido-Fernández *et al.*, 2020; Kersting, 2016). Thus, in principle, skipping breakfast is often associated with poor dietary behavior, *e.g.* frequent snacking and consumption of high-fat foods (Kuchling, 2020; Hopkins *et al.*, 2017).

Interplay between kiosk offerings and nutritional habits

Regarding the acceptance of the school kiosk, it was found that it is mediocre, as 42% of respondents never buy from the kiosk and 44% buy at the most once or twice a week. Reasons for this are the limited or unhealthy offer (Questionnaire S2, question 26). The majority of students and teachers (83%) always or often paid attention to buying fresh products. However, the offer at the kiosk contained few fresh products, which could explain the lower purchasing behavior at the kiosk. Furthermore, 84% of the subjects state that buying whole foods is very important to important to them. However, the school kiosk does not offer anything in this regard. It seems that the offer at the kiosk only functions as an emergency supply, as it is not very varied and unhealthy. The respondents who state that they eat a very healthy to predominantly healthy diet prefer mixed diets, heavily plant-based mixed diets and whole foods. Vegans and vegetarians are in the medium healthy range with their statements. One explanation for this could be that they are not sure whether their diet contains all the essential nutrients in the right proportions. Students and teachers who indicate a strong preference for a mixed meat-based diet report their eating habits more in the moderately healthy to unhealthy range. Obviously, some of them are aware that too much meat could be unhealthy, but they still do not want to miss it. Consumption of convenience foods, such as frozen pizza or prepared meals, is part of the food range for respondents who say they eat healthy. This means that these people consider many convenience products to be “healthy”.

Slightly more than half of the adult students and teachers surveyed purchased from the kiosk. Students with lower education levels, such as vocational high schools (73%) and vocational schools (72%), have a higher purchase share at the kiosk than high school students. High school students (59%) purchased slightly more from the kiosk than technical high school students (54%). There is no data from the preparatory training school due to very low participation in the survey. It was found that, in contrast to studies with underage students (Hermans *et al.*, 2020), adult students purchase more often food from kiosks. Male respondents (67%) purchase more from the kiosk than female respondents (53%). Of those respondents who bring food from home for the entire school day, almost half (47%) never shop at the kiosk, but 33% of these respondents shop at the kiosk once a week and 14% twice a week. Respondents, who only bring a snack to school, purchase slightly more from the kiosk (20% once a week, 20% twice a week and 12% thrice a week). It was found that out of the respondents who never take food from home and never shop at the kiosk, 38% also do not eat breakfast. The question here is whether these respondents eat only in the afternoon, shop on the way to school or buy snacks during possible free periods outside of school. Since more than half of the respondents (58%) do not eat breakfast at home, it is necessary to provide a healthy, wholesome and tasty food offerings at the school kiosk to the school community.

Healthier kiosk offerings in the new feel-good cafeteria on the long-term

In the course of all relevant changes, the creation and furnishing of a new feel-good lounge before the kiosk was made possible. The space and room concept for the new feel-good cafeteria was realized together with the school administration. The concept for new lunch offers and longer opening hours was established and implemented. Longer opening hours offer students the opportunity to buy healthy snacks and meals, which can promote healthy eating habits and encourage a balanced diet. Healthy eating can have a positive impact on their ability to learn and to focus or concentrate. A kiosk with healthy options that is opened longer allows students to keep themselves fueled with nutritious food even during long school days. By promoting healthy eating through such a cafeteria, a school creates a positive school environment that supports student well-being and performance. The gradual change to a healthy offer at the kiosk was a great challenge for the catering provider (Hennchen and Schäfer, 2023; Guthke, 2022) who had to develop new purchasing sources to offer regional, seasonal, fair-trade and organic products according to the needs of the school community. A precise list of the food purchased was a trade secret. However, the purchasing behavior was evaluated based on statements by the caterer. During the gradual changeover of the food on offer, the wholesome options were well received. In some cases, the price was a little too high for the pupils, but many bought anyway. The question is whether the school community will continue to buy the newly created offerings at the higher prices in the long run. The developed strategy and dynamically applied implementation culture helped step by step to change from an unhealthy to a healthy school offer and follow the quality standard of the German Nutrition Society. Knowing that healthy food is available at school could also prevent unhealthy snacking on the way to school, which in turn could increase purchases at the kiosk in the long term.

Impact, limitations and recommendations

School is a setting where people spend many years of their lives. An increasingly important task of schools is to provide the school community with a healthy diet to counteract lifestyle diseases such as obesity, diabetes mellitus and high blood pressure. Education and support of a balanced and healthy diet is essential for physical health and good performance, reducing risks for civilization diseases and improving quality of life and productivity. Therein, certain nutrients (e.g. *n-3* fatty acids and antioxidants) can improve cognitive function which can have a positive impact on cognitive performance, learning and concentration. In turn, this can reduce the burden on the healthcare system and free up resources for other areas. However, the reality in schools is quite different and a change is obvious. The practicability of the improvement approach and the principle of incremental planning, doing, reviewing and acting, which involves all stakeholders, have proven to be key to a successful impact. There is no general recommendation for action, but always a situation-specific one, if possible pro-active. The need for a change has to become aware and the change has to be lived.

In addition, the introduction of standards for healthier meals in school kiosks requires political support and prioritization. If this issue is not seen as urgent, appropriate measures may not be taken. Therefore, the Minister's call for the quality standard of the German Nutrition Society to become mandatory for school catering is an important step. Furthermore, there may be a lack of awareness and education about the importance of a healthy diet and the effects of unhealthy food on health. This may result in policy makers not seeing an urgent need to set standards for healthier meals. Furthermore, schools may not have sufficient financial resources to set up the necessary infrastructure to prepare and sell such meals. In such cases, applications for municipal, county and governmental support or

support by foundations or crowd-sourced funding or other creative local business ideas have to be started.

This study has provided valuable insights and helped to improve understanding of students' nutritional status and nutritional needs. However, it is important to consider the limitations of the study and perhaps complement it with other research methods to provide a more complete picture. The limitations of the study included the low response rate of the questionnaire during the difficult period of the corona pandemic, the short time frame specified by the ministry for conducting the survey, the sometimes low motivation of students and teachers for the topic of nutrition and the fluctuating motivation of the food provider.

The food industry and other interest groups protecting own economic interests can hinder the development and implementation of policy standards. Setting standards for healthy meals at school kiosks requires a complex decision-making process involving various stakeholders such as government, school authorities, health organizations, nutrition experts and the food industry. Hence, this process can be difficult and time-consuming. If stakeholders involved are empowered and resilient, they will succeed.

The certification of a school is carried out in accordance with general national standards and guidelines for educational institutions. The working topic "Healthy School" has to be part of the school vision and a matter of principle. For example, DIN EN ISO 9001 defines the requirements for quality management systems and can also be applied to educational institutions to ensure effective quality assurance. The topic of "healthy schools" could be addressed here and the improvement and performance of a healthy kiosk offer could be monitored. However, further standards may be relevant which specify requirements for learning and continuing education services (DIN 29990) or for mechanical security of doors, windows and gates (DIN EN 1627), as given for the implementation of a new feel-good cafeteria lounge.

Conclusions and outlook

The new implementation concept and culture successfully led to the improvement of the school kiosk offer according to the quality standard of the German Nutrition Society and finally to the creation and establishment of a feel-good cafeteria lounge. Regarding the school kiosk offerings at school, the insights were unique and let conclude that the kiosk offering had to be expanded to include at least one warm, healthy and wholesome midday meal, so that the hunger can be satisfied quickly even during short breaks in a long school day. A prerequisite were longer kiosk and cafeteria opening times. Buying fresh and wholesome food was important to many respondents, and after a gradual changeover phase, unhealthy products were no longer sold at the kiosk. The healthy food offerings now meet the politically required standard for healthy food supply at schools. The feel-good area in the cafeteria invited students to linger during free periods and buy healthy meals more often. For a broader implementation and successful transformation, it is also important to include the vision of a healthy school at all levels and the permanent working topic "Healthy School" in the certification program as a matter of principle. The change has to be lived. Further research is important how to guide schools towards a complete sustainability concept and its translation.

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Supplementary material

The supplementary material for this article can be found online.

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Supplementary information

Incremental implementation concept for healthy eating habits in German school with kiosk

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Information S1. Information on German vocational training centers

German vocational training centers usually house many different types of schools with different degrees (Ministerium für Bildung und Kultur Saarland, 2021), such as upper secondary schools with specializations in business, technology, and health (high school diploma, in German Abitur), specialized upper secondary schools with specializations in business, technology, and health (vocational diploma, in German Fachabitur), vocational schools with specializations in health and social services, technology, business and administration, and housekeeping and outpatient care (intermediate secondary education, in German Mittlerer Bildungsabschluss), vocational schools for automotive mechatronics technician, German-French automotive training branch, bodywork and vehicle construction mechanic, professional driver, agricultural and construction machinery mechatronics technician, two-wheel mechatronics technician, metal worker, chimney sweep, hairdresser, office management clerk, sales clerk, retail sales clerk (training occupation degree) and the training preparation program.

Information S2. Example of the implementation of the food offer via email information to the whole school community

(Translated into English)

New at the BBZ St. Ingbert

Healthy breakfast and snacks


WHERE: Kiosk in the school courtyard
and
Kiosk/Cafeteria in Building D

WHEN: from 7:00 - 11:30 a.m. (inner courtyard) from
7:00 – 12:00 (Building D)

PLANNED: Hot meals on 2 days,
Serving from 12:00 - 13:30.
For the trial phase, a meal voucher must be
purchased from the kiosk the day before.

You will also find a healthy drinks selection.

BBZ reusable cups are available for €2.



CATERING Service
Bio - Vollkornprodukte - Regional **BIO**

Wholemeal roll with sausage and cheese	2,50 €
Wholemeal roll vegetarian	2,50 €
Wholemeal baguette with turkey breast	3,50 €
Wholemeal baguette with tomato and mozzarella cheese	3,50 €
Juicy wholemeal wrap	3,50 €
Veggi burger	3,50 €
Wholemeal baguette with sausage (halal)	3,50 €
Muesli in a glass	2,50 €
Yoghurt in a jar	2,50 €
Fruit salad in a jar	2,50 €
Pasta with tomato sauce in a jar	3,00 €
Deposit for the jar	2,00 €

Information S3. Information with flyer for special kiosk offer announced on the school website and provided on the *25th Healthy Eating Day*

Dear School Community,

The *Healthy Eating Day* was first launched in 1998 by the German Association for Nutrition and Dietetics (VFED) and takes place every year on 7 March. On this day, our school, in cooperation with the school administration, the kiosk operator and the student council, would like to draw attention to the importance of healthy eating. This action on *the 25th Healthy Eating Day* also underlines the idea of a healthy school.

The School Management



A snapshot taken on the *25th Healthy Eating Day*



Information S4. Implementation of the new feel-good cafeteria lounge

Room space before implementation



Shutter of the food kiosk counter



Building outside area



Newly established feel-good cafeteria lounge area



Information S5. Ten examples of the newly created healthy lunch offerings with prices announced on the website and one example of a bi-weekly menu plan

**Dienstag
13.09.22**



Gemüsesuppe mit Vollkorn-Egnette



Orientalische Vollkornreispfanne mit Hähnchen

**Donnerstag
15.09.22**



Kartoffel-Zucchini-Pfanne mit Salat



Vollkorn Burger mit Entenfleisch und Salat



Kartoffelsuppe mit Lüsti

**Dienstag
20.09.22**



**Gemischter Salat mit warmen
gebratenen Fischenstreifen**



**Vollkornnudeln mit frischer
Tomatensauce und Parmesan**

**Donnerstag
22.09.22**



Fellkartoffel mit Ei und Kräuterquark



Gebratene Gnocchi mit Eihrei

**Dienstag
27.09.22**



Fisch mit Zucchiniplanne

Donnerstag
29.09.22



**Fartoffelpfanne mit frischen
Champignons und Kräuterfrischkäse**



Fartoffeleratin mit Salat

Dienstag
04.10.22



Eiäsecmelette mit Salat



Curry-Firse-Flanne mit Gemüse

Donnerstag
06.10.22



**Vollkornnudelpfanne mit
frischem Gemüse**



**Schnitzel natur mit
Beilagensalat**

Dienstag
11.10.22



Vegetarische Gemüselasagne



**Gemischter Salat mit warmen
gebratenem Tofu**

Donnerstag
13.10.22



**Fartoffel-Zucchini-
Pfanne mit Salat**



Cnocchi mit Spinat und Ricotta

Example of a bi-weekly menu plan

**Speiseplan Mittagessen im September in der Cafeteria
im Bau D von 12 bis 13.30
Dienstag und Donnerstag
Vom 13.09.22 bis 30.09.22**

Dienstag 13.09.22	Kartoffelsuppe mit Rösti	5,00 €
Donnerstag 15.09.22	Reispfanne mit Gemüse und Hähnchenstreifen	6,00 €
Dienstag 20.09.22	Vollkornburger mit Salat vegetarisch oder mit Pute	5,00 €
Donnerstag 22.09.22	Gemischter Salat mit geb. Tofu od. Thunfisch	6,00 €
Dienstag 27.09.22	Pellkartoffel mit Ei und Kräuterquark	5,00 €
29.09.22	Lachsfilet mit Gemüse	6,00 €

**Bonverkauf täglich an beiden Cafeterias
mindestens 1 Tag vorher kaufen!!!**

Questionnaire S1. Developed questionnaire with 42 questions
(translated into English)

Dear School Community,

With the following questions, we would like to get an impression of the nutritional knowledge and behavior of the individual, how the use and acceptance of the school kiosk is and what wishes there are regarding healthy school catering. For the evaluation of the questionnaire, all questions must be answered completely and truthfully. This survey is anonymous and voluntary. Thank you for taking 10 minutes of your time.

1. I agree to participate in the online survey and to the processing of my personal data. *Mark only one.*

yes

no

2. How do you rate your eating habits? *Mark only one.*

	1	2	3	4	5	6	
Unhealthy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very healthy

3. Where did you get your nutrition knowledge? Several answers are possible.
Select all that apply.

- From school lessons
- From home
- From the Internet
- From books and/or magazines
- From the environment/leisure time
- Other

4. How good is your knowledge of basic nutrition (e.g., nutrients, fiber, vitamins, minerals, and trace elements)? *Mark only one.*

- Extraordinary knowledge
- Considerable knowledge
- Mediocre knowledge
- Little knowledge
- No knowledge

5. Do you know the food pyramid of the German Nutrition Society DGE?
Mark only one.

yes

no

6. Do you have a diet-related disease (e.g., diabetes, elevated cholesterol, elevated blood lipids, and obesity)?

Mark only one.

yes

no

7. Do you pay attention to ingredient claims when buying food?

Mark only one.

- Always
- Often
- Occasionally
- Rarely
- Never

8. Do you pay attention to quality labels/organic labels when buying food?

Mark only one.

- Always
- Often
- Occasionally
- Rarely
- Never

9. Do you look for low-fat content when buying food?

Mark only one.

yes

no

10. When buying food, do you pay attention to low sugar content?

Mark only one.

yes

no

11. Is it important for you to season with herbs and to salt less?

Mark only one.

yes

no

12. Do you look for fresh products when buying food?

Mark only one.

- always
- often
- occasionally
- rarely
- never

13. How important is it for you to buy whole foods?

Mark only one.

- Very important
- Important
- Rather less important
- Unimportant

14. What is your main diet?

Mark only one.

- Mixed diet
- Strongly meat-based mixed diet
- Strongly plant-based mixed diet
- Vegetarian: everything except meat and fish
- Vegan: only plant products
- Whole food diet
- Other

15. Do you eat a hot meal (lunch or dinner) at least one time per day?

Mark only one.

- always
- often
- occasionally
- rarely
- never

16. How often do you consume convenience foods such as frozen pizza, ready-to-eat pasta, or rice dishes, fish sticks, canned meals, etc.?

Mark only one.

- Several times a week
- 1 - 2 times per week
- Several times per month
- 1 - 2 per month
- Never

17. How often do you do sports per week?

Mark only one.

- Not at all
- 1 time
- 2 - 3 times
- More than 3 times

18. Do you make sure to maintain your weight?

Mark only one.

- yes
- no

19. Do you have breakfast at home?

Mark only one.

- always
- often
- occasionally
- rarely
- never

20. What do you drink before you come to school? Several answers are possible.

Select all that apply.

- Coffee
- Cocoa
- Milk
- Tea
- Still water
- Sparkling mineral water
- Fruit juice
- Fruit juice spritzer
- Smoothie
- Soft drink e.g. Coke
- Energy drink
- Other
- I do not drink anything

21. Do you bring food from home to school?

Mark only one.

- Yes, the food for the whole school day
- Yes, only a snack (e.g. a chocolate bar)
- No

22. How many times a week do you have classes longer than 12:30?

Mark only one.

- 1 time
- 2 times
- 3 times
- 4 times and more
- Never

23. At what time do you eat for the first time at school?

Mark only one.

- Just before school starts
- 1st break
- 2nd break
- 3rd break
- 4th break
- Not at all

24. How often do you buy drinks during school hours?

Mark only one.

- 1 time per week
- 2 times per week
- 3 times per week
- 4 times per week
- 5 times per week
- > 5 times per week
- Never

25. What do you drink at school? Several answers are possible.
Select all that apply.

- Coffee
- Cocoa
- Milk
- Tea
- Still water
- Sparkling mineral water
- Fruit juice
- Fruit juice spritzer
- Smoothie
- Soft drink e.g. Coke
- Energy drink
- Other
- I do not drink anything

26. When you spontaneously feel hungry and want to buy something at the kiosk, what do you buy?
Several answers are possible.
Select all that apply.

- Coffee bits
- Pretzel/pretzel stick with or without topping
- Baguette with cheese
- Meatball roll
- Baguette with sausage
- Schnitzel sandwich
- Sandwich with mozzarella or feta
- Sweet bar
- Baguette without topping
- I do not buy anything because there is not enough choice
- I do not buy anything because it is too unhealthy
- I do not buy anything for other reasons

27. How often do you buy food during school hours?
Mark only one.

- 1 time per week
- 2 times per week
- 3 times per week
- 4 times per week
- 5 times per week
- > 5 times per week
- Never

28. If the vending machines were out of order and you had to buy a drink from the kiosk, what would you buy? Several answers are possible.
Select all that apply.

- Mineral water still or carbonated
- ACE juice
- Apple spritzer
- Iced tea peach or lemon
- Coffee
- Cocoa
- Coke
- Sprite
- Mezzo Mix

29. How much do you drink at school on average?

Mark only one.

- Up to 250 ml
- 500 ml
- 750 ml
- 1l and more

30. Is it important to you to consume regional and seasonal products?

Mark only one.

- yes
- no

31. How important are the topics of sustainability and fair trade (fair trade) to you when it comes to nutrition?

Mark only one.

- Very important
- Important
- Rather less important
- Unimportant

32. Is it important to you that organic products are offered at school?

Mark only one.

- yes
- no

33. How much money are you willing to spend on school meals per day?

Mark only one.

- 1 - 2 €
- 3 - 5 €
- More than 5 €
- No money

34. When should the school kiosk be open for you?

Mark only one.

- Continuous from 7:15 a.m. until the last lesson
- During all breaks
- Only during the first two breaks.

35. If the kiosk were to change its menu to healthy, wholesome organic food, which of the following dishes would you try?

Please select 6.



Juicy wholemeal wrap (also vegetarian)



Vegetarian wholemeal schnitzel burger



Wholemeal baguette with vegan toppings



Wholemeal baguette vegetarian (e.g. mozzarella, lettuce and tomatoes)



Wholemeal baguette with ham (low-fat), lettuce and tomatoes



Wholemeal pretzel without salt (e.g. with sesame seeds)



Soup of the day (from fresh ingredients) with wholemeal roll



Salad with raw vegetable dressing and biodressing



Wholemeal pasta salad



Potato salad with organic dressing



Lentil salad with Asian organic dressing



Tomato-Mozzarella skewers and other vegetable skewers



Herb curd dip with wholemeal rolls



Natural yoghurt with a selection of fresh fruit (also lactose-free)



Curd cheese with fresh fruit selection (also lactose-free)



Fresh fruit skewers



- Muesli with fresh milk, soy milk, lactose-free milk or natural yoghurt and fresh fruit



- Organic muesli bar without sugar



- Nut selection



- Selection of dried fruits



- Fresh fruit selection

36. If the kiosk were to change its range to healthy drinks (organic quality), which of the following products would you buy?
Select at least two.

- Fresh milk
- Lactose-free milk
- Buttermilk
- Herbal tea
- Coffee (black/with milk/with vegan milk substitute)
- Mineral Water
- Juice spritzer (organic apple, rhubarb etc.)

37. What do you miss in the kiosk? (If you don't miss anything, please enter: nothing)

38. How old are you?

Mark only one.

- 16 - 17
- 18 - 19
- 20 - 21
- 22 - 30
- 31 - 40
- 41- 50
- > 50

39. What gender are you?

Mark only one.

- female
- male
- diverse

40. How tall are you? (in cm, e.g. 175; please enter the number only)

41. What is your weight? (in kg, e.g. 65; please enter the number only)

42. Are you a student or a teacher?

Mark only one.

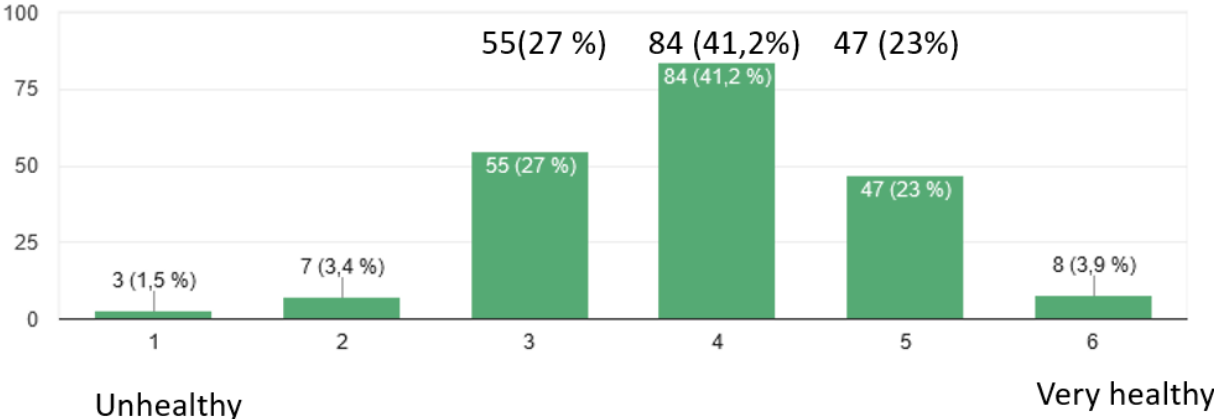
- Student of upper secondary school
- Student of specialized upper secondary school
- Student of vocational school (BFS)
- Student of vocational school
- Student of training preparation program
- Teacher

Questionnaire S2. Summarized data collected from mostly 204 participants, illustrated as bar or pie chart per question
(translated into English)

1. I agree to participate in the online survey and to the processing of my personal data, which are exhaustively enumerated in the information letter.

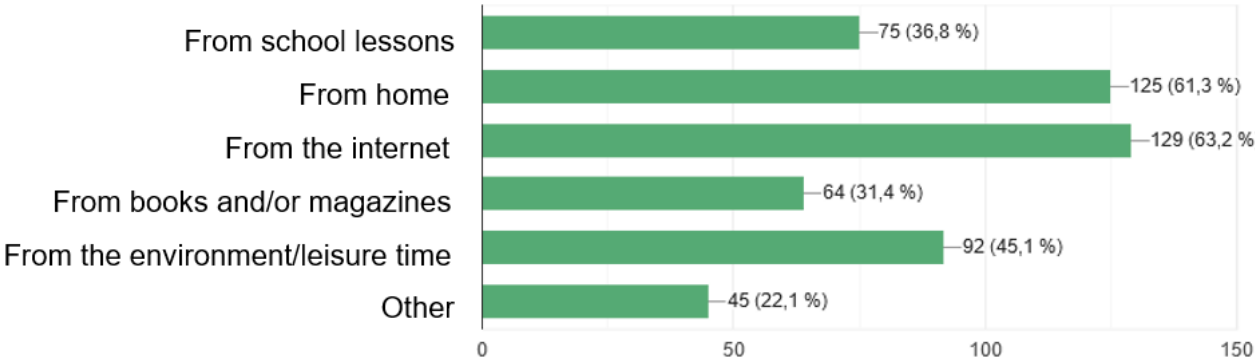
Without marking "yes" or "no", the online questionnaire could not be submitted.

2. How do you rate your eating habits? 204 Responses

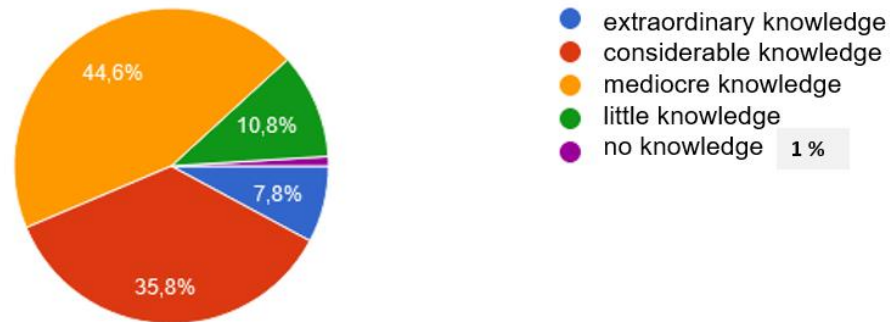


3. Where did you get your nutrition knowledge? Several answers are possible.

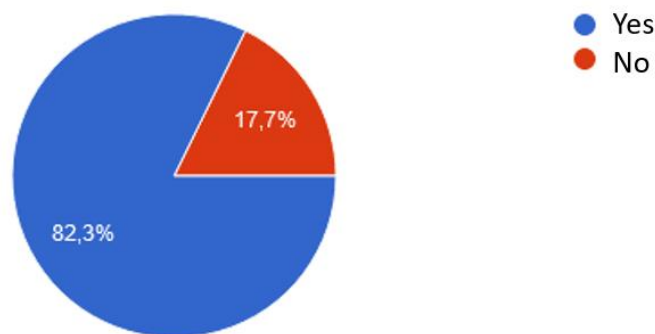
204 Responses



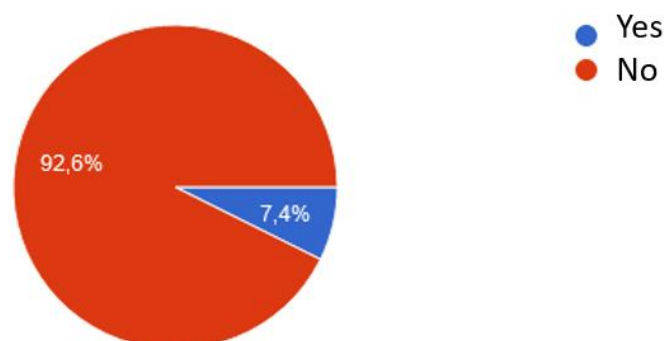
4. How good is your knowledge of basic nutrition (e.g., nutrients, fiber, vitamins, minerals, and trace elements)? 204 Responses



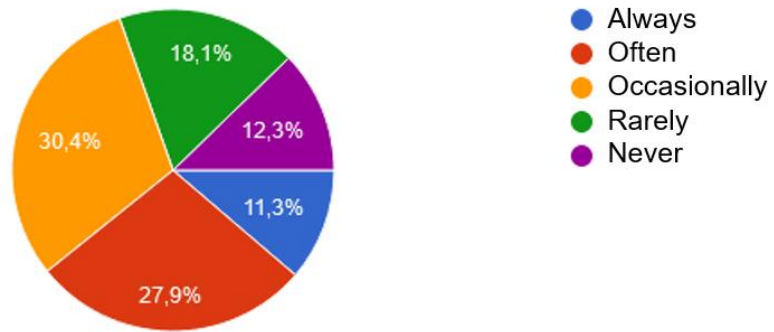
5. Do you know the food pyramid of the German Nutrition Society DGE? 203 Responses



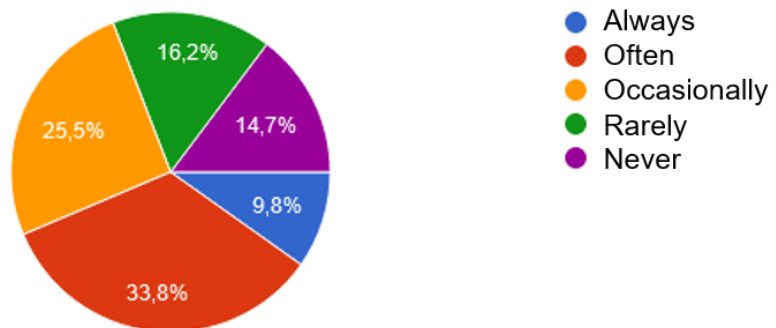
6. Do you have a diet-related disease (e.g., diabetes, elevated cholesterol, elevated blood lipids, obesity)? 204 Responses



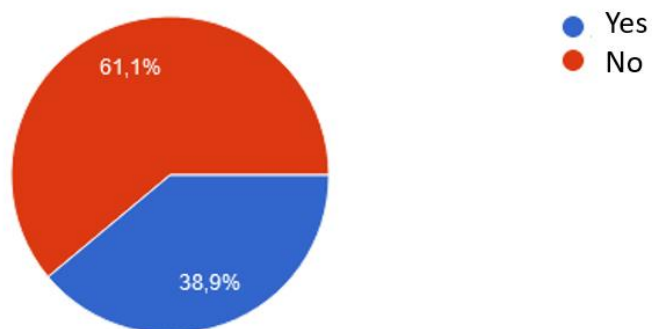
7. Do you pay attention to ingredient claims when buying food? 204 Responses



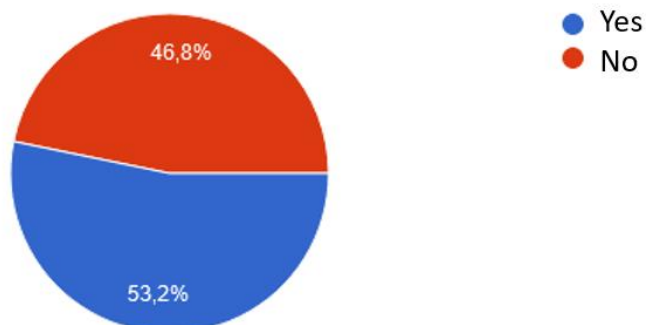
8. Do you pay attention to quality labels/organic labels when buying food? 204 Responses



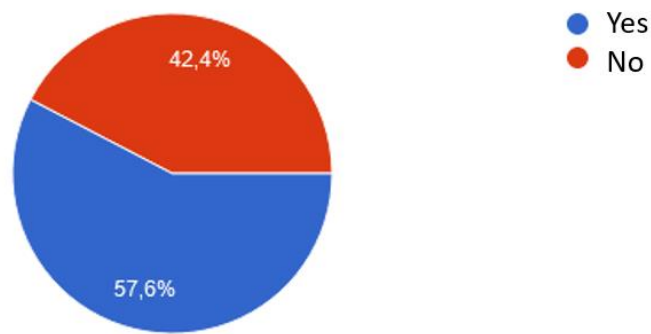
9. Do you look for low-fat content when buying food? 203 Responses



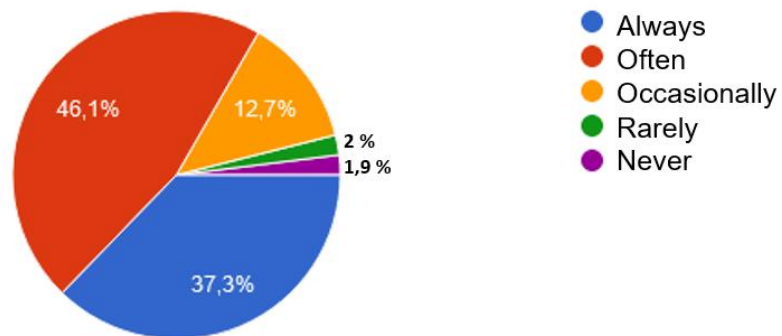
10. When buying food, do you pay attention to low sugar content? 203 Responses



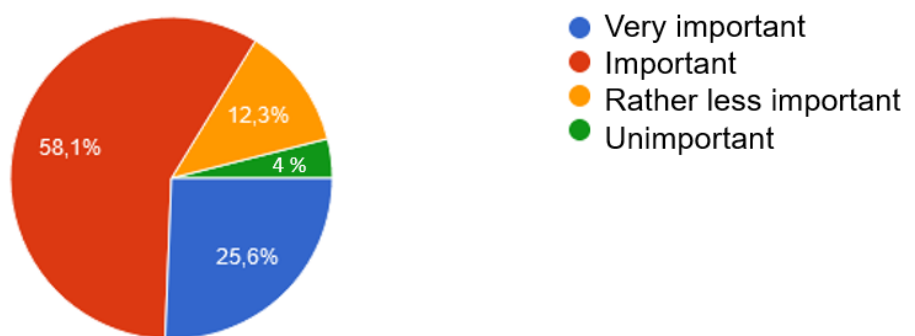
11. Is it important for you to season with herbs and to salt less? 203 Responses



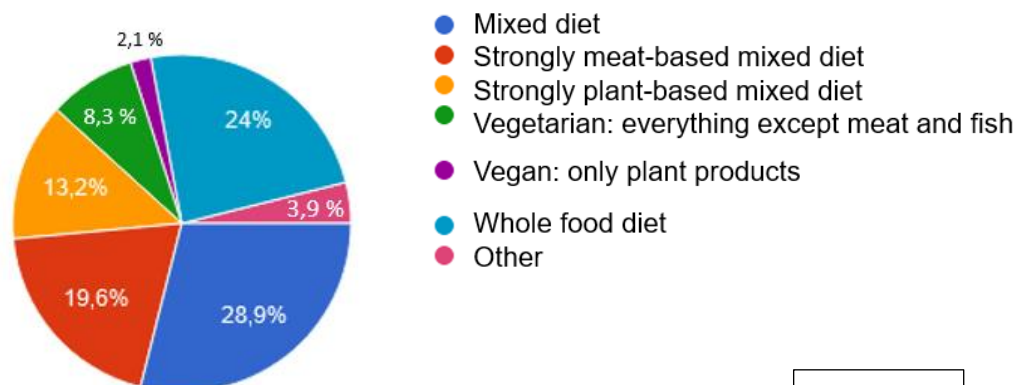
12. Do you look for fresh products when buying food? 204 Responses



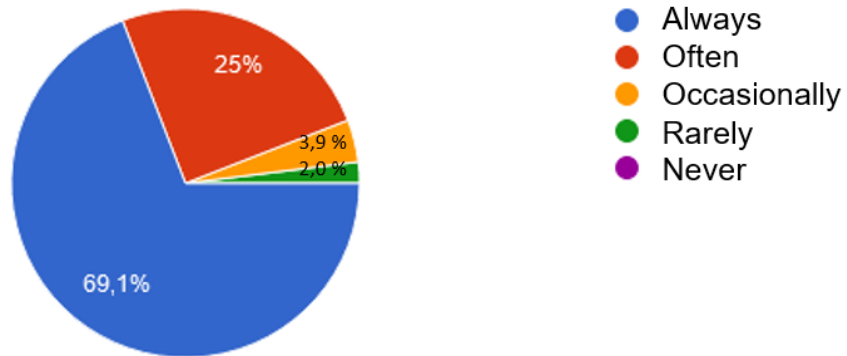
13. How important is it for you to buy whole foods? 203 Responses



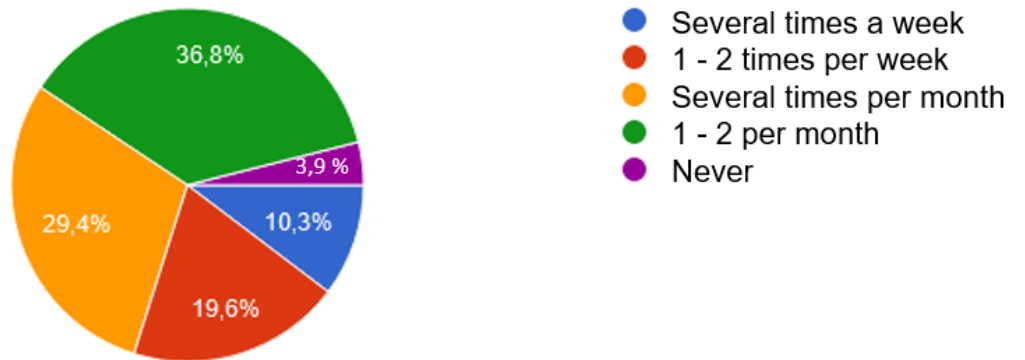
14. What is your main diet? 204 Responses



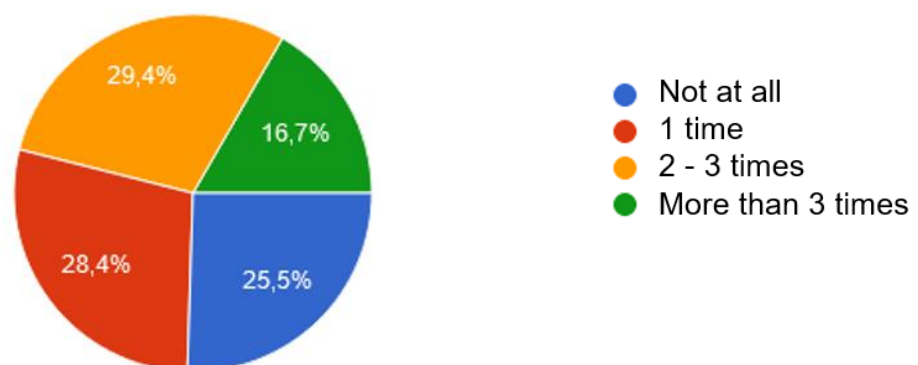
15. Do you eat a hot meal (lunch or dinner) at least 1 time per day? 204 Responses



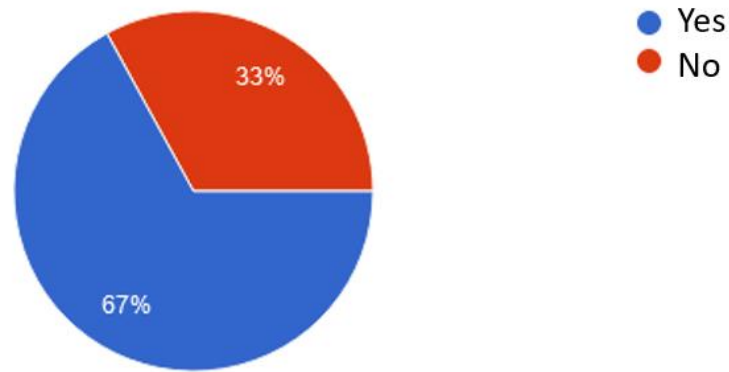
16. How often do you consume convenience foods such as frozen pizza, ready-to-eat pasta or rice dishes, fish sticks, canned meals, etc.? 204 Responses



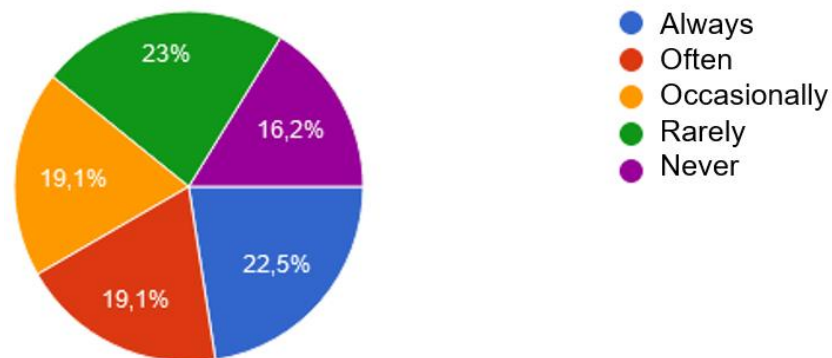
17. How often do you do sports per week? 204 Responses



18. Do you make sure to maintain your weight? 203 Responses

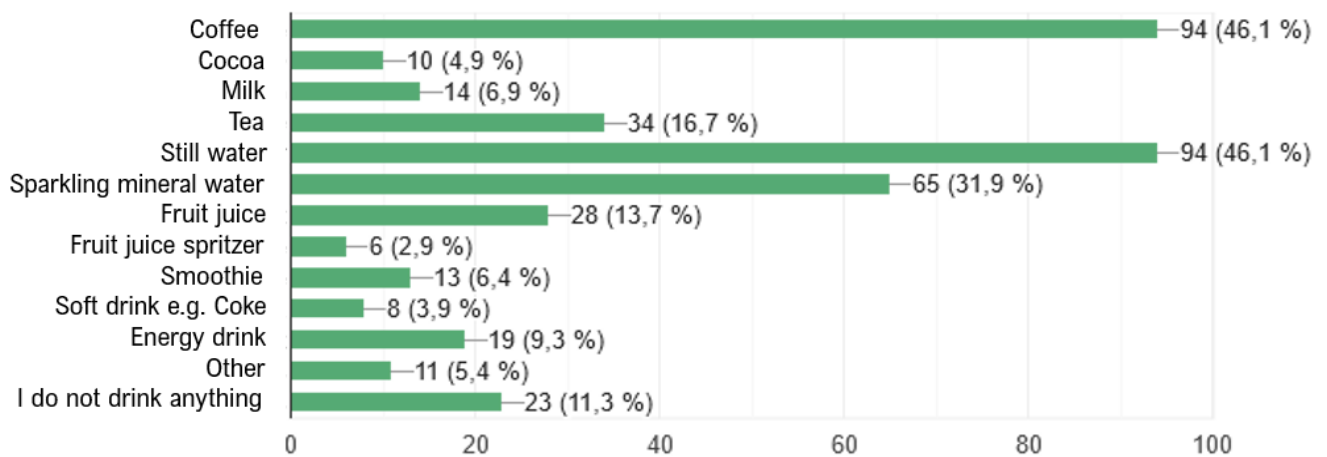


19. Do you have breakfast at home? 204 Responses

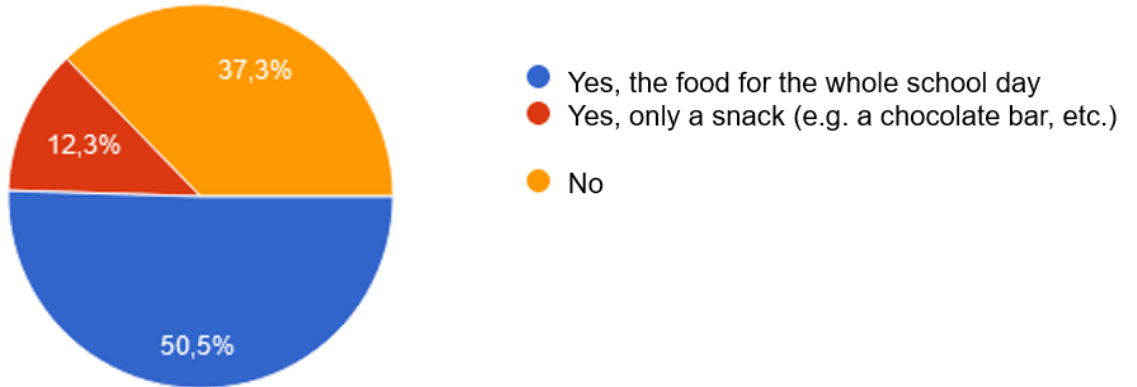


20. What do you drink before you come to school? Several answers are possible.

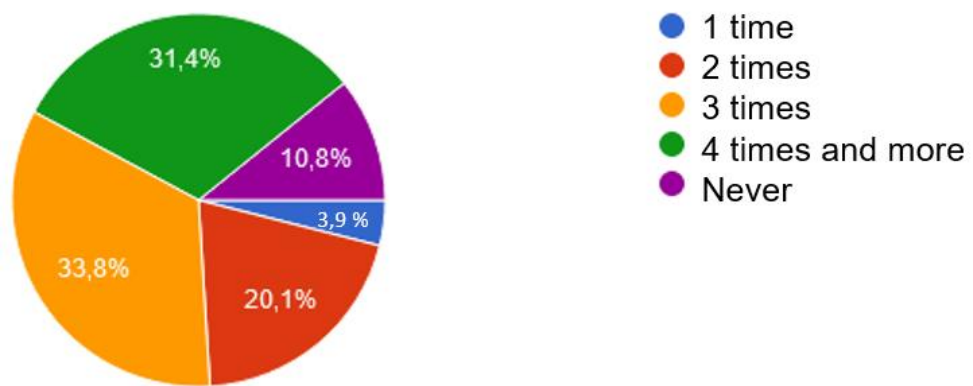
204 Responses



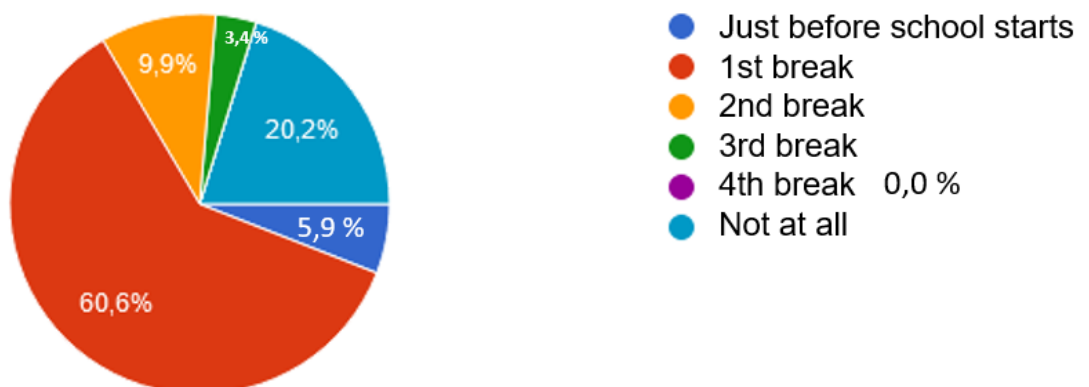
21. Do you bring food from home to school? 204 Responses



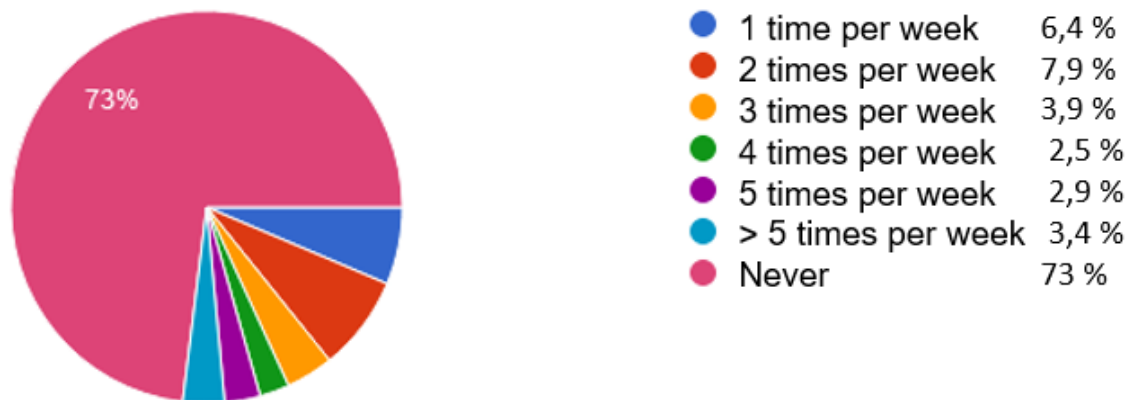
22. How many times a week do you have classes longer than 12:30? 204 Responses



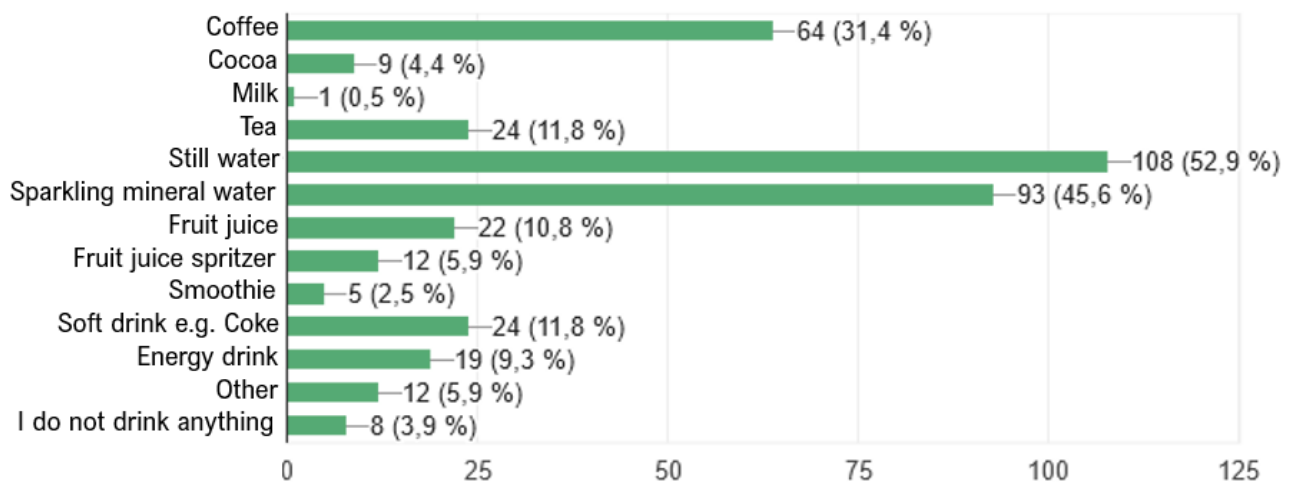
23. At what time do you eat for the first time at school? 203 Responses



24. How often do you buy drinks during school hours? 204 Responses

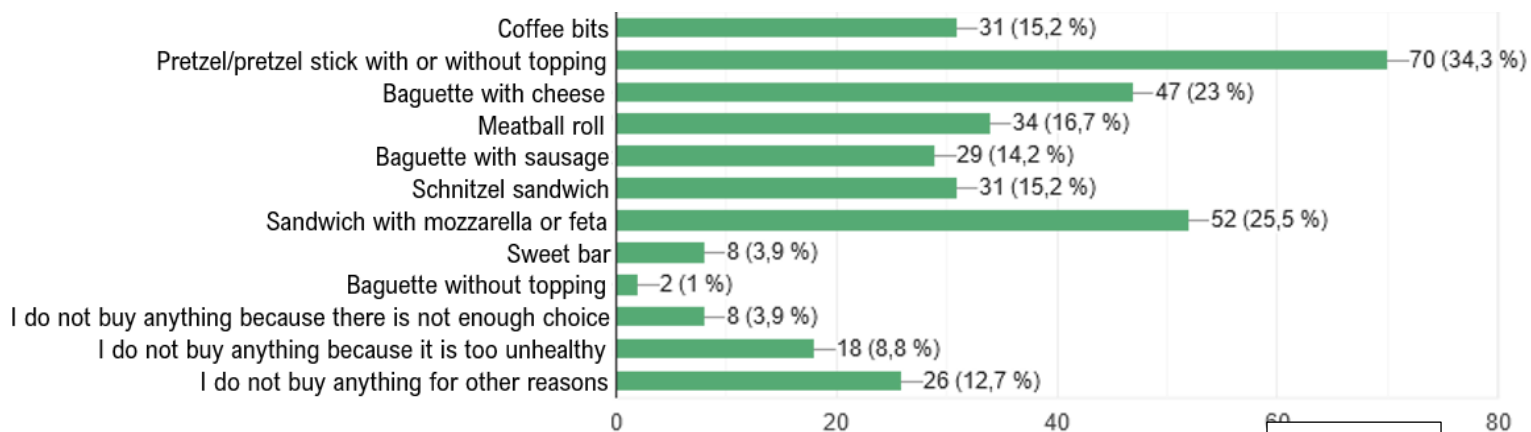


25. What do you drink at school? Several answers are possible. 204 Responses

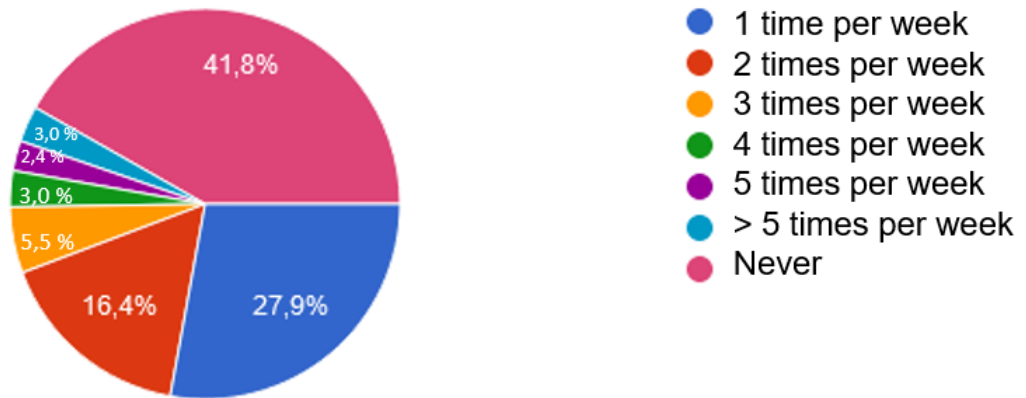


26. When you spontaneously feel hungry and want to buy something at the kiosk,

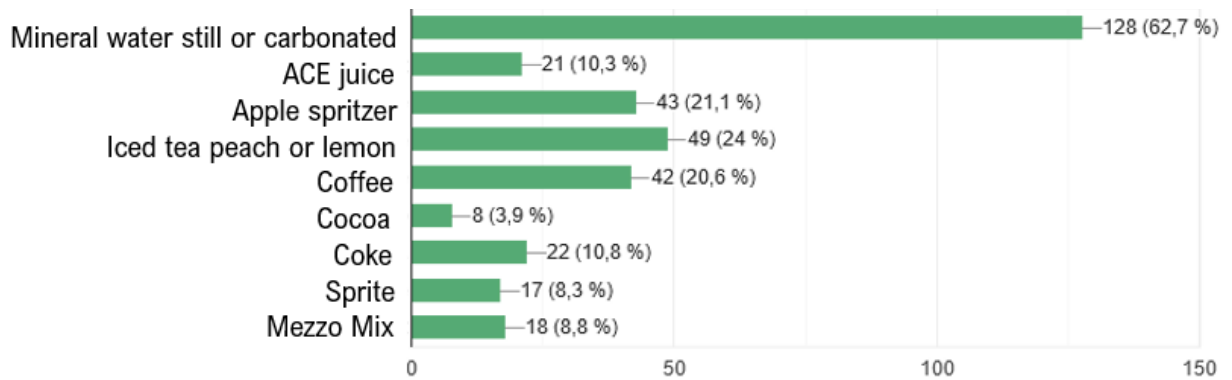
what do you buy? Several answers are possible. 204 Responses



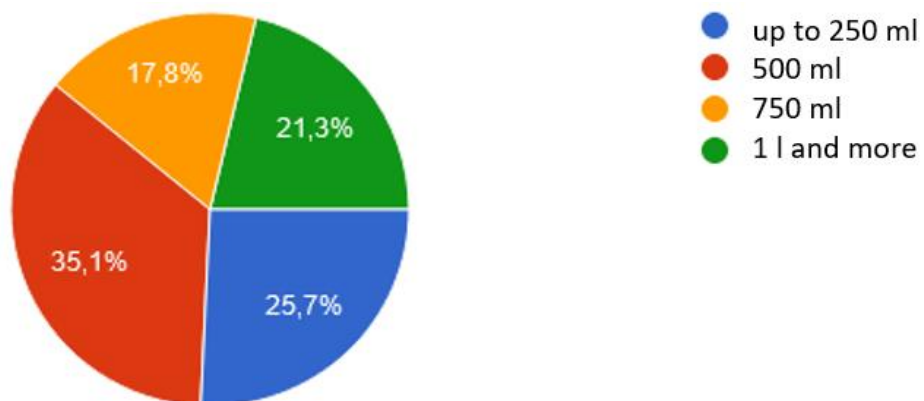
27. How often do you buy food during school hours? 201 Responses



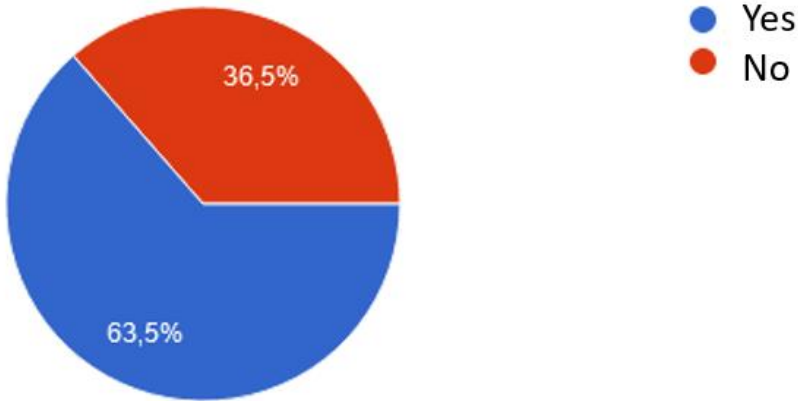
28. If the vending machines were out of order and you had to buy a drink from the kiosk, what would you buy? Several answers are possible. 204 Responses



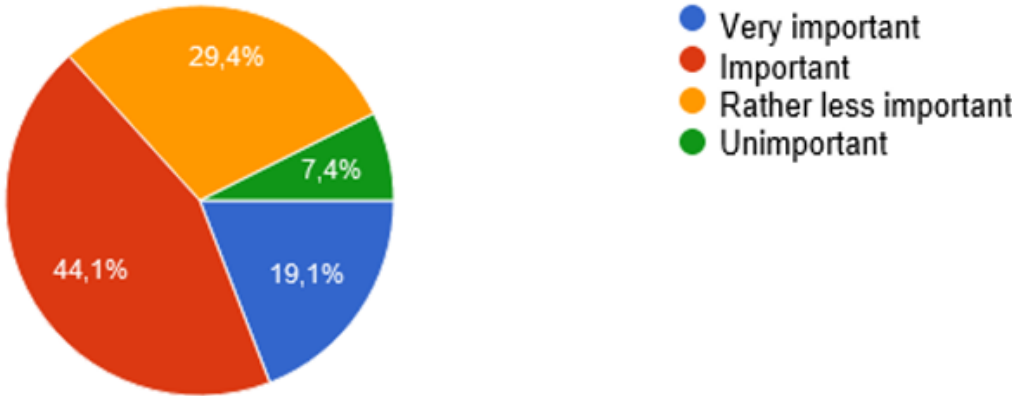
29. How much do you drink at school on average? 202 Responses



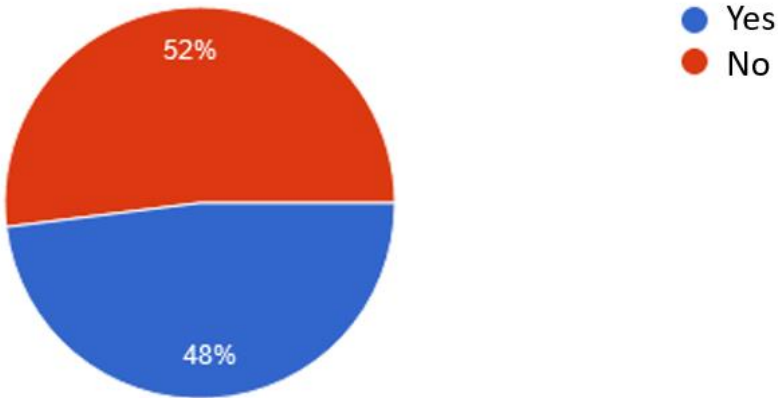
30. Is it important to you to consume regional and seasonal products? 203 Responses



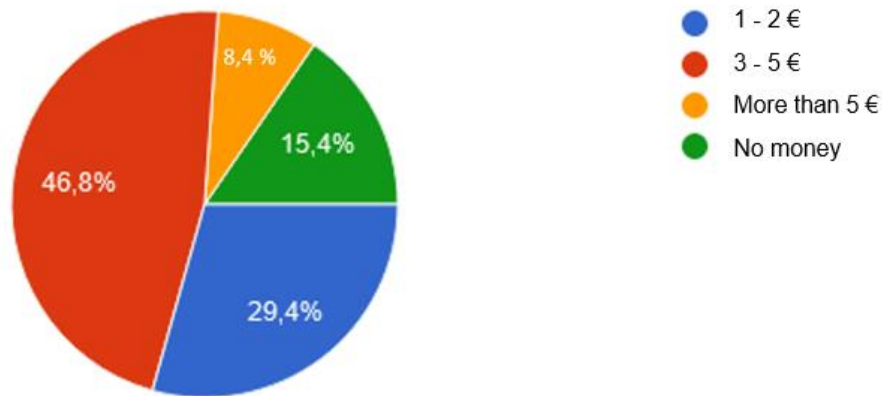
31. How important are the topics of sustainability and fair trade (fair trade) to you when it comes to nutrition? 204 Responses



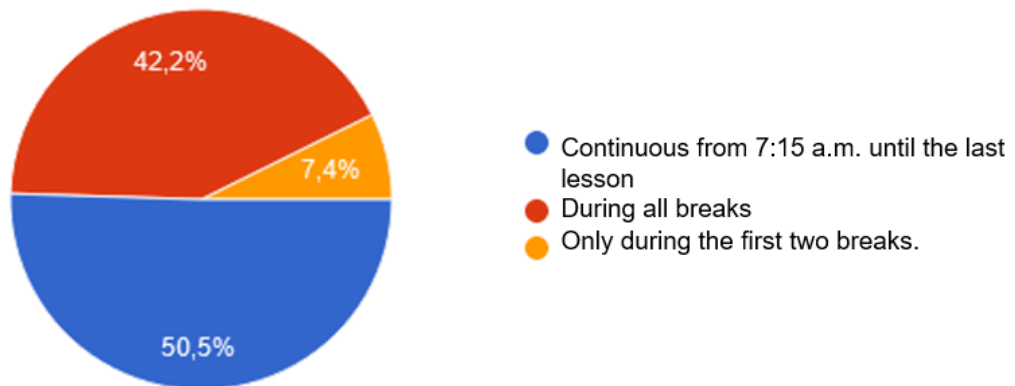
32. Is it important to you that organic products are offered at school? 204 Responses



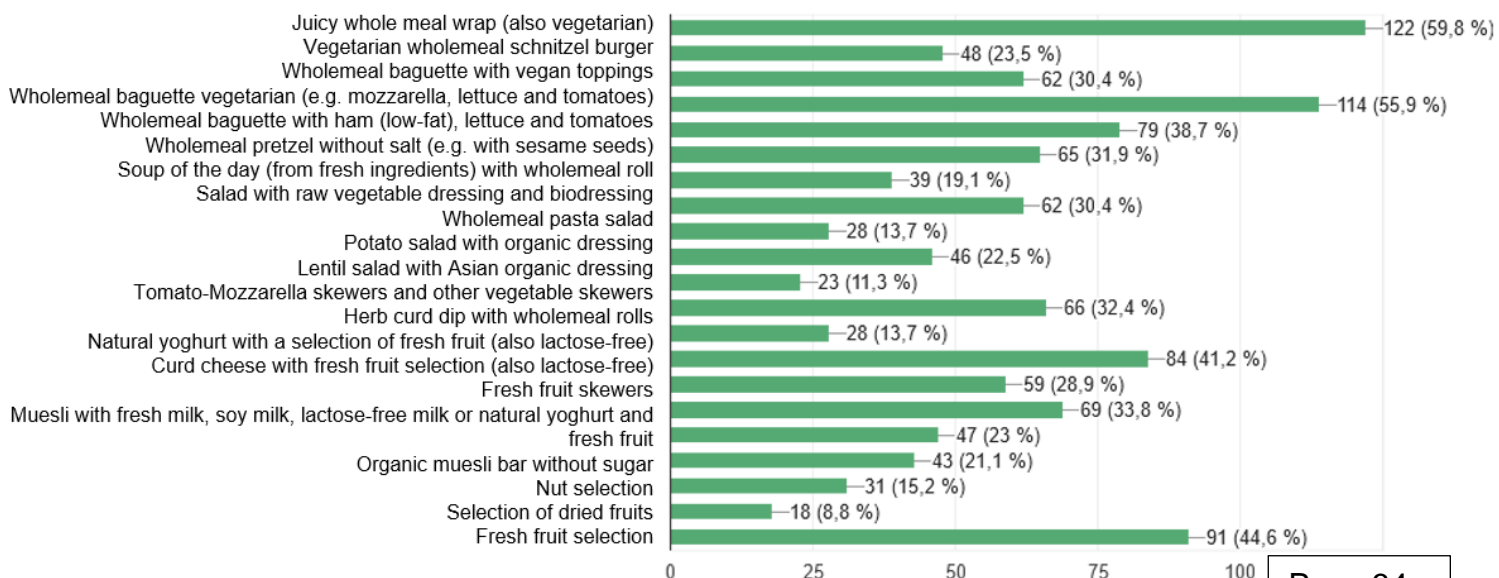
33. How much money are you willing to spend on school meals per day? 204 Responses



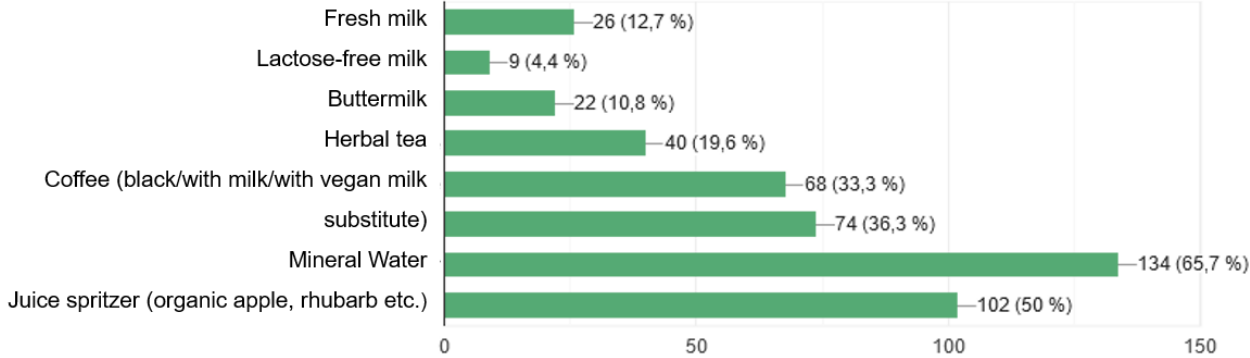
34. When should the school kiosk be open for you? 204 Responses



35. If the kiosk were to change its menu to healthy, wholesome organic food, which of the following dishes would you try? 204 Responses



36. If the kiosk were to change its range to healthy drinks (organic quality), which of the following products would you buy? 204 Responses

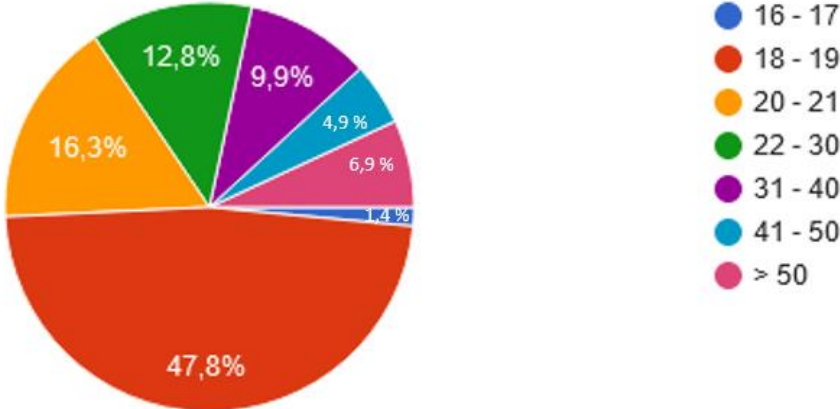


37. What do you miss in the kiosk? 162 Responses - Summary

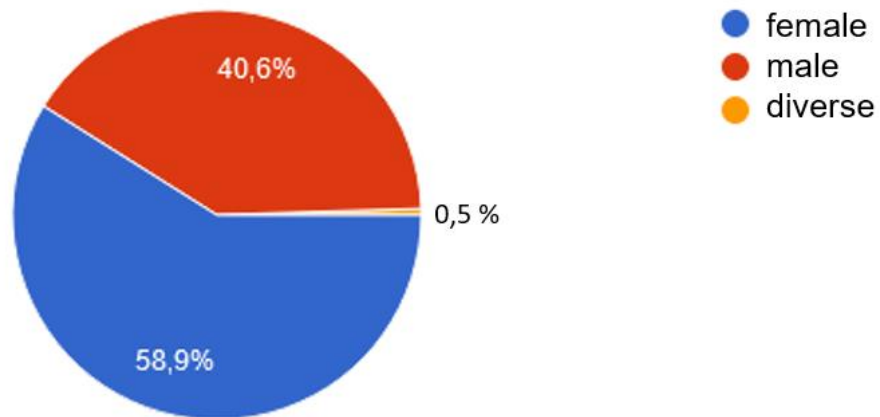
Healthy offerings that are missed: Salads, fresh fruit, wholemeal products, healthy drinking options, organic products, selection of vegetarian options, wraps without mayonnaise, fitness food with more protein and fewer calories, gluten-free bread alternatives, healthy packed lunches to fill your own lunch box including a drink, healthy baguettes, ready-made fruit cups, good coffee, muesli with quark or yoghurt and fruit, fresh milk, fresh vegetables, organic options, healthy spritzer options, feta cheese sandwich.

Unhealthy offerings that are missed: wine, beer, pizza, nut buns, energy drinks: Red bull, Monster, Rockstar

38. How old are you? 203 Responses



39. What gender are you? 202 Responses



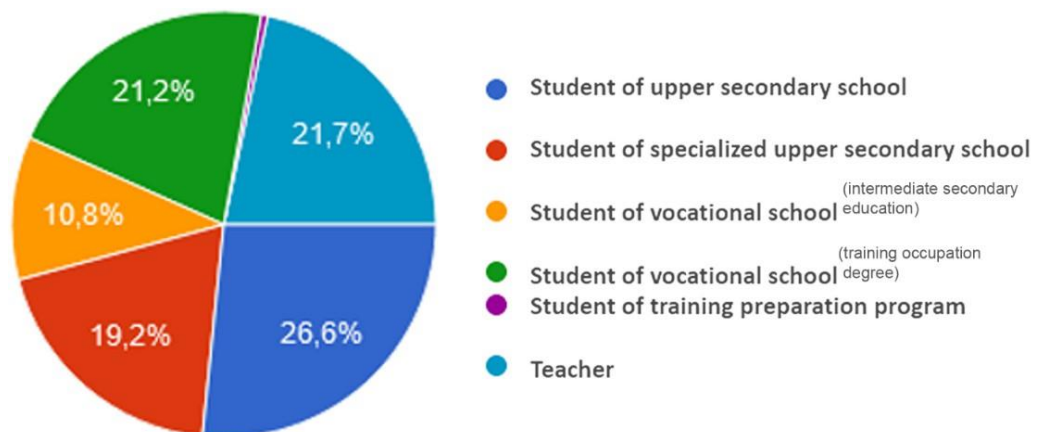
40. How tall are you? (in cm, e.g. 175; please enter the number only) 200 Responses

4 persons did not indicate a size.

41. What is your weight? (in kg, e.g. 65; please enter the number only) 194 Responses

10 persons did not specify a weight.

42. Are you a student or a teacher? 203 Responses



4. PUBLIKATION 2

Sustainable Schools: Changing Society Towards Sustainability

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Sustainable Schools: Changing Society Towards Sustainability

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Keywords: 17 Sustainable Development Goals (SDGs) | change management | education for sustainable development | empowerment | holistic school development | SMART method

ABSTRACT

A change in mindset has taken place in educational institutions, characterised by a growing awareness of sustainability and environmental aspects. Inspired by the UNESCO Global Action Programme, various ministries have allowed to be certified as a School of Sustainability at different levels, albeit on a voluntary basis and without substantial integration to date. As a good example, the implementation process towards a certified School of Sustainability was monitored to promote a change towards sustainability. It was a holistic process that encompassed various areas of school life. Sustainability was not only related to normal school lessons but anchored cross-sectionally. A strategy was developed and opportunities were identified to overcome major challenges to promote long-term change and to permanently integrate principles of sustainability into everyday school life. Projects were defined and divided into three complexity levels of implementation according to the 17 Sustainable Development Goals. The cross-sectional education for sustainable development (ESD) was established as a holistic school development approach. The school developed itself into a sustainable organization so that what has been learned is put into everyday practice. The everyday school setting with sustainability multipliers became key to changing the mindset of families and thus society as a whole towards greater sustainability. As demonstrated, a concrete implementation concept helps educational institutions to find financial resources and organisational structures, whereby staff qualification and mandatory (not voluntary) certification is key to achieve 'ESD for 2030'.

1 | Introduction

Sustainability has developed more strongly than almost any other topic in recent years (Statista 2024). Early on, the term *Sustainable Utilisation* was used in connection with forestry. Trees could only be felled to the extent that they could grow back to conserve resources in the long term (von Carlowitz 1713; Teichert et al. 2024). Nowadays, the various definitions of the term *Sustainability* have fundamental similarities. Firstly, sustainability is always focused on the present and the future and therefore has a temporal reference. Secondly, resources,

material/intangible goods, economic/ecological units, etc. should be protected, especially if they are not renewable. Thirdly, the continued existence of a reference object should be ensured in the short and long term.

Sustainability comprises three dimensions, which include economic, social, and ecological goals (United Nations Department of Economic and Social Affairs 2020). Sustainable development requires social change, and thus, education for sustainable development (ESD) plays a central role in achieving this goal (Federal Ministry of Education and Research 2020). The UNESCO

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Global Action Programme from 2015 to 2019 (UNESCO 2015) pursued the goal of bringing about long-term systemic change in the education system and transforming ESD from a project into an established structure. Through ESD, every individual realises that their actions have consequences not only for themselves and their immediate environment but also for others. Everyone can contribute to making the world a better place. This mindset is crucial to initiating change and tackling urgent global problems (Barth 2021; Federal Ministry of Education and Research 2022a).

After several years of successful implementation of the UNESCO Global Action Programme on ESD (UNESCO 2018) and the 17 Sustainable Development Goals (SDGs) (United Nations Department of Economic and Social Affairs 2020), the new programme *Education for Sustainable Development: Towards achieving the 17 SDGs* (ESD for 2030) was launched in 2021 (Byun 2020). This new UNESCO programme underlines the importance of ESD in achieving the global 2030 Agenda for Sustainable Development. The 17 SDGs set a pioneering direction for the future of our world (Federal Ministry of Education and Research 2022b; UNESCO 2021). In total, 193 countries have committed themselves to enabling all people to live in dignity by 2030 while ensuring the long-term preservation of natural resources (World Hunger Help 2024).

Schools play a key role as multipliers in creating a sustainable future, as they shape a large part of young adults with influence on their everyday lives and further development. Given the many sustainability crises such as climate change, species loss, and growing social injustice, school education has an impact on their knowledge, attitudes, emotions, and values and can therefore help them to shape the future (Grund and Brock 2022). However, students must develop skills and value orientations themselves. Therefore, education for sustainable development (ESD) requires action-oriented, transformative pedagogy (Rieckmann 2024). It follows the didactic principles of learner-centredness and accessibility, discovery and networked learning, action and reflection orientation, transformative and transgressive learning, participation orientation, vision orientation, and the connection of social, self-related, and method-oriented learning with subject-related learning (Lamanauskas and Malinauskienė 2024; O'Grady 2023). Learning environments that support reflection, participation, and critical thinking among students are necessary for structural, qualitatively profound transformative learning processes to take place (Rieckmann 2024).

The topic of sustainability is largely included in school curricula for individual subjects. However, it does not take up much space (Ministry of Education and Culture 2022). Although various ministries in Germany offer voluntary certification programmes such as the 'School of Sustainability' (Ministry of the Environment, Climate, Mobility, Agriculture and Consumer Protection 2023b), there is no obligation for schools to participate. While this non-mandatory framework allows for substantial integration in line with 'ESD for 2030', it raises questions about commitment, effectiveness and comparability. Implementation depends largely on the contribution and commitment of multipliers, that is, teachers who agree to intensively accompany the certification process and on students who support the change.

Schools are advised and financially supported in the certification process through teaching materials, appropriate training courses, event programmes, and cooperation with ESD experts outside of schools.

This study contributes to the scientific foundation of school transformation processes in the context of sustainable development. It systematically and quantitatively analysed the comprehensive implementation process of school sustainability strategies within the framework of the desired certification as a School of Sustainability. For a holistic school development approach, it was hypothesized that key is the development of an evidence-based implementation model with project measures according to the 17 Sustainable Development Goals (SDGs) categorised as low, medium, and high content and organisational complexity. Exemplarily, two projects were examined in depth and critically discussed on the basis of the quality criteria of the National Action Plan for Education for Sustainable Development and their position within the 2030 Agenda.

2 | Methods

2.1 | Quantitative Project-Based Methodology

A project-based learning and teaching framework was used to promote, acquire, and develop a range of skills in the students and a deeper knowledge through active engagement with real and relevant problems and challenges (Seidel and Gotzen 2024). The project-based method focuses on active, self-directed, and cooperative learning in which the outcome is open. As a project carried out in teams in class, students worked on a sustainability task within a set period to present practical results at the end. It required the organisation of both the individual work process and the group work process. Project-based learning is a quantitative method as it is characterised by clear objectives and measurable results. The quantitative method is evident in project-based learning in six phases. Although project-based learning is often accompanied by qualitative methods, a quantitative methodology was systematically integrated (Supporting Information S1). At the beginning of a project, specific goals were defined, which were concretised by measurable indicators. These indicators included, for example, product quality, student and teacher satisfaction, or learning success based on partial results. The time limit of a project made it possible to precisely record the amount of time spent, while the consumption of resources such as materials or working time was also quantified. Progress was continuously documented and analysed, for example, in the learning diaries of students. At the end of the project, a tangible result or product was created, for example, through objectively assessed feedback or tests. Individual or group performance was measured based on criteria such as the quality of the work results or compliance with deadlines. Thus, progress and success were objectively demonstrated (Almulla 2020; Balleisen et al. 2024).

The stages of the quantitative project-based methodology were set as follows:

1. Project idea and definition: The idea of realising a specific sustainability project began with a task, an idea, and a topic. Project goals and boundaries were defined.

2. **Project planning:** The implementation of the project was preceded by comprehensive project planning with the support of the students so that joint ideas for the sustainability project were developed. Teamwork had to be organised, and work plans, schedules, and timetables had to be developed, that is, the structure of the project was formed and documented. In addition, milestones were agreed upon, for example, at which point in time which hurdle must be reached. It was advantageous to involve as many different people as possible in the project, such as sponsors, experts, institutions, and colleagues.
3. **Project implementation and control:** The project-based method had a student-centred approach, which meant that students took responsibility for their learning and allowed for interdisciplinary learning, as the sustainability projects can be integrated into all subjects. They were actively involved in project design and implementation, learnt to identify and discuss problems, collected data, and developed solutions. Changing plans in the event of unexpected problems and dealing with them were important aspects of project control.
4. **Decision-making process:** Monitoring a project guarantees its progress, and the solutions found were peer-reviewed to achieve substantiated, informed decisions.
5. **Reflection, evaluation, completion, and maintenance:** At the end of the project, students reflected on their experiences and the results achieved. This encouraged critical thinking and learning from successes and mistakes. The assessment was carried out through self-reflection and feedback from peers, including teachers. The sustainability project, well-integrated into the life of the school but ongoing, has to be nurtured and maintained in defined intervals.
6. **Dissemination:** The outcome was made visible to others. Work in the area of public relations, for example, scientific publication, homepage, press, and exhibition, was important tasks to be handled for motivation, transparency, and tolerance.

2.2 | Quantification of Achieved Goals

For certification, important steps must be defined and progress achieved must be measurable. A specific (S), measurable (M), attractive (A), reasonable (R), and time-bound (T) method, termed SMART (Eremit and Weber 2015), was used to quantitatively evaluate the project goals. This evaluation process was peer-reviewed by the Ministry of Education and Culture.

2.3 | Certification Process

Several ESD multipliers were appointed within the school community, who constantly accompanied and promoted the certification process. The application for certification was made to the Ministry by submitting a self-disclosure of the educational institution including a letter of motivation (Ministry of the Environment, Climate, Mobility, Agriculture and Consumer Protection 2023a). The self-disclosure contained a brief

description of the previous school activities in the area of ESD and information on five fields of action (Ministry of Education and Culture 2022; Ministry of the Environment, Climate, Mobility, Agriculture and Consumer Protection 2023a).

3 | Results

3.1 | Incentives for Certification

The benefits and reasons that motivate educational institutions to participate in a certification process for sustainability are as follows (Basheer et al. 2024; Bonilla-Jurado et al. 2024; Reimers 2024).

1. **Quality improvement:** Certification helps educational institutions to improve their quality in terms of sustainability by setting clear standards and criteria. The feedback received helps to identify weaknesses so that the topic can be continuously optimised.
2. **Reputation:** Certification as a *School of Sustainability* improves the reputation and standing of the educational institution and can increase the confidence of parents, students, teachers, and the public in the quality of the educational institution.
3. **Competitiveness:** In the increasingly competitive educational environment, certification helps the educational institution to stand out from others and increase its attractiveness. This can have a positive impact on student enrolment and the financial stability of the school.
4. **Compliance with standards:** Through certification, schools ensure that they meet 'ESD for 2030' educational standards and guidelines for sustainable development. This is particularly important to comply with government regulations and ensure the quality of the educational experience for students.
5. **Professionalisation:** Teachers and staff remain proactively active in change management and are supported through further training opportunities.
6. **Social responsibility:** Educational institutions can demonstrate their commitment to sustainability issues and act as multipliers to promote awareness of this important topic and transfer and communicate sustainability to society as a whole.

3.2 | Strategy for Implementation

Projects, sub-projects, goals, and tasks were defined (Figure 1). The SMART method (Eremit and Weber 2015) was used to effectively achieve project goals. It represents five criteria (i.e., specific, measurable, attractive, reasonable, and time-bound) by which a goal is to be achieved. Specific means that the objective is formulated clearly and unambiguously so that everyone involved knows exactly what is to be achieved. The specificity gives a clear direction. Measurable means that there are concrete criteria that can be used to assess or measure whether progress and ultimately the goal has been achieved. Attractive means that the goal is motivating and achievable for everyone involved. It should not be too easy or unrealistically difficult so that they are committed to

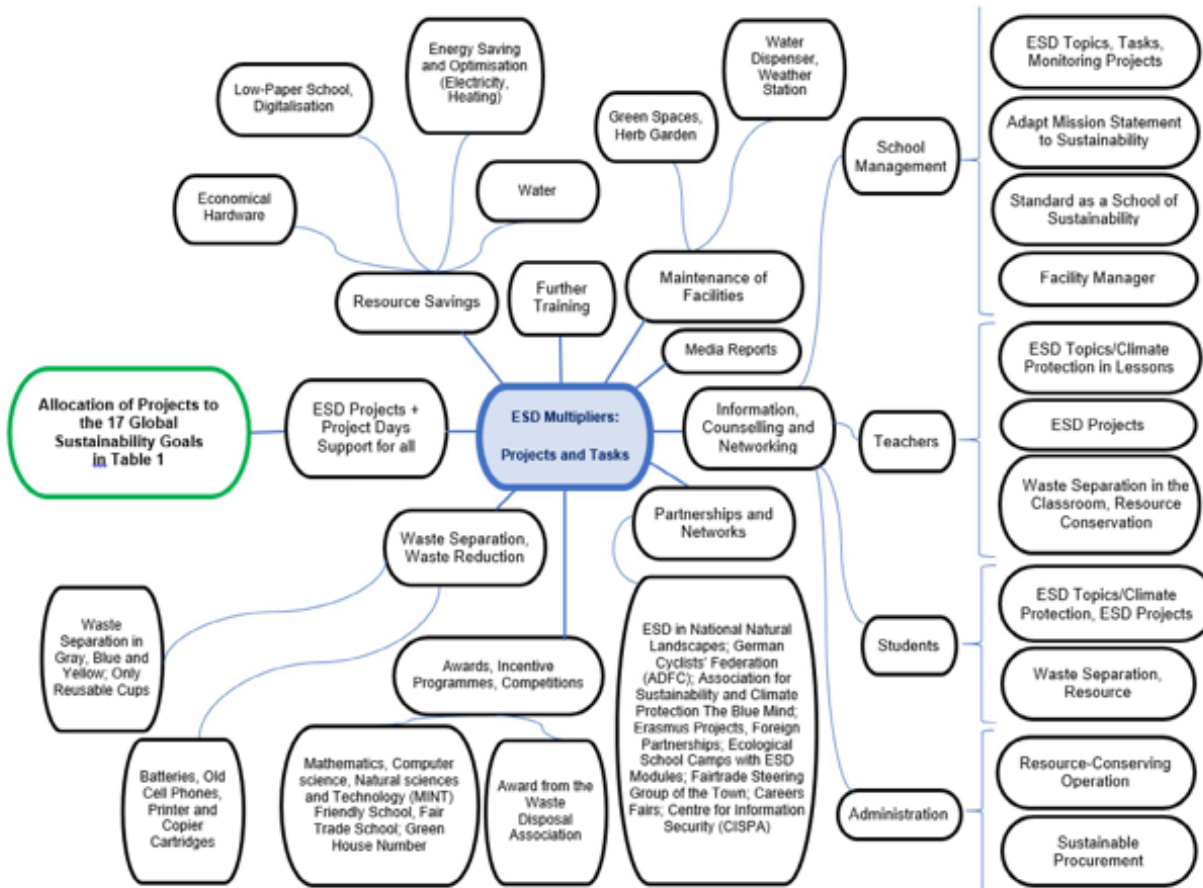


FIGURE 1 | Evoking projects, sub-projects, goals, and tasks of ESD multipliers compiled as a network.

working towards the goal. Reasonable means that the goal is realistic and can be realised with the available resources and framework conditions and makes sense in terms of the overall project. Time-bound means that the goal has a clear deadline by which it is to be achieved. The time limit helped to keep the focus and to better plan the work steps. The appointed four ESD multipliers continuously supported the projects and tasks and promoted the certification process. In the course of the first projects, more and more teachers became involved in the certification process and agreed to become multipliers who have one paid reduction hour per week, but this is often not enough. The respective teacher in each project was required to ensure that each project succeeded.

Projects identified as relevant were allocated to the 17 SDGs (Table 1) (Sharma and Andreou 2018). They were divided into three categories, that is, easy to implement, moderately difficult to implement, and complex to implement, based on specific challenges (specified in Supporting Information S2). As a strategy, the easy-to-implement projects are recommended to be started first, which trigger motivation through success and fast results and progress, followed by more complex projects. These projects can be adapted according to the age group and resources of the school. The simpler projects require less time and resources, while the more complex projects require long-term planning and cooperation. These projects offer students the opportunity to actively engage with the 17 SDGs and make a positive contribution





to their community and beyond. School projects targeting the 17 SDGs are therefore often multi-dimensional and help to achieve several goals simultaneously, reflecting the complexity and interconnectedness of the challenges.

Young people who are confronted with more sustainability in their educational institution tend to behave more sustainably (Grund and Brock 2022). Numerous skills of the students were improved through practicing project-based learning and decision-making, problem-solving, cooperation, communication, self-directed and self-regulated learning, and self-efficient time management (Seidel and Gotzen 2024). Project-based learning was accompanied by a great commitment on the part of the teaching staff. In the following, the implementation of project-based learning was exemplified by two projects in detail. The project *Healthy Snacks* falls into the moderately-difficult-to-implement category, and the project *Forest Classroom* with the follow-up projects falls into the complex-to-implement category.

3.3 | Moderately-Difficult-To-Implement Project *Healthy Snacks*

The SDGs were associated with this project as follows. For SDG 2 and SDG 3, the students learnt to cook, prepare healthy food,

TABLE 1 | Allocation of projects to the 17 SDGs (World Hunger Help 2024) divided into three categories, that is, easy to implement (green dot), moderately difficult to implement (orange dot), and complex to implement (red dot); the two projects discussed are in bold.

17 SDGs	Projects allocated and color-coded depending on complexity of implementation
1. No Poverty 	<ul style="list-style-type: none"> ● Support for the homeless through biscuit-baking campaigns ● Support of Caritas by donations in kind from teachers ● Various fundraising campaigns (e.g., Christmas café)
2. Zero Hunger 	<ul style="list-style-type: none"> ● School cooking in cooperation with food-sharing ● Sustainability working group at the technical college ● Food rescue project ● Seminar subject Healthy Nutrition ● Raised bed in planning
3. Good Health and Well-Being 	<ul style="list-style-type: none"> ● Teacher sport (yoga) ● Addiction prevention ● AIDS event ● First-aider training for students and school paramedics ● Seminar subject Herbal Medicine ● Herb bed ● Healthy teacher breakfast ● Cafeteria and kiosk only with snacks that comply with the German Nutrition Society (DGE) recommendation ● International Nonprofit Bone Marrow Donor Center (DKMS) typing campaign ● Cookery book Staying Healthy at School and University ● Cosy student lounge in the cafeteria area ● Oases of peace in the green areas of the schoolyard in planning
4. Quality Education 	<ul style="list-style-type: none"> ● Visit to a training and job fair ● Book exchange shelf ● Cinema week on important sustainability topics ● Mobile phone garage for every classroom in planning ● Exercise trail ● Career orientation week ● Seminar subjects on Sustainability ● Annual sustainability project week ● Science, Technology, Engineering, and Mathematics (STEM)-friendly school ● Forest Classroom with follow-up projects
5. Gender Equality 	Refers to all projects
6. Clean Water and Sanitation 	<ul style="list-style-type: none"> ● Water dispenser with still and sparkling water, fairtrade coffee
7. Affordable and Clean Energy 	<ul style="list-style-type: none"> ● Participation in a programme for the sustainable and healthy development of schools (EWA-Plus) ● Energy-saving lamps in planning ● Fuelling station for e-bikes in planning ● Charging station for e-cars ● Solar system
8. Decent Work and Economic Growth 	<ul style="list-style-type: none"> ● Stock market simulation game

(Continues)

TABLE 1 | (Continued)

17 SDGs	Projects allocated and color-coded depending on complexity of implementation
9. Industry, Innovation, and Infrastructure 	<ul style="list-style-type: none"> ● Cooperation with the Competence centre for e-mobility ● Cooperation with the university STEM campus and student laboratory for cyber security (CISPA) ● Art project 'turning old into new' (reusing old canvas surfaces) in planning
10. Reduced Inequalities 	<ul style="list-style-type: none"> ● Educational experience days in the biosphere reserve ● Project on Catching up after Corona
11. Sustainable Cities and Communities 	<ul style="list-style-type: none"> ● Waste collection campaign Picobello (winner of the 2023 ideas competition) ● Recycled toilet paper, paper towels, and copy paper ● Greenhouse number
12. Responsible Consumption and Production 	<ul style="list-style-type: none"> ● Reusable cups and bottles with the school logo ● Visit to the beekeeper ● Giveaway and swap market ● Critical city tour ● Sale of products made by students ● Collection campaigns for recycling (batteries, old mobile phones, plastic lids, etc.) in planning ● Fairtrade school and classes ● Project SDG Seating for the common room ● Open youth workshop
13. Climate Action 	<ul style="list-style-type: none"> ● School cycling campaign (winner of the 2024 ideas competition) ● Participation in city company-run ● Set of mountain bikes for the school class ● Bicycle parking
14. Life Below Water 	<ul style="list-style-type: none"> ● Measures to avoid plastic (reusable cups, cloth bags for borrowed school books, plastic teaching unit) ● Visit the marine fish farm in the planning ● Stream ecosystem project
15. Life on Land 	<ul style="list-style-type: none"> ● Organic farm visit ● Art in the schoolyard in planning ● Making insect hotels and birdhouses ● Creating a flower meadow
16. Peace, Justice and Strong Institutions 	<ul style="list-style-type: none"> ● German Trade Union Confederation project on co-determination and democracy ● Resistance movement exhibition on the namesake of the school Willi Graf ● Visit to Verdun ● Mediator training and school against racism in planning ● School partnerships with France
17. Partnerships 	<ul style="list-style-type: none"> ● Young Biosphere ● Association for marine and climate protection The Blue Mind ● German National Cyclists' Association (ADFC) ● Ecological school hostel Spohns Haus ● Fairtrade steering group and adult education centre of the town ● Employment agency ● Partner companies at the job fair ● Erasmus project with Lithuania ● Mentorship for learning with refugees in planning

and carry out healthy shopping planning. The gain in knowledge was intended to counteract civilisation diseases and to ensure that nothing was thrown away. For SDG 4, the topic of nutrition was part of education. For SDG 5, all students learnt to

deal with the topic of healthy eating. For SDG 6, students took care to use water sparingly when preparing food. For SDG 12 and SDG 13, the students paid attention to shopping sustainable, seasonal, healthy, preferably fresh, and inexpensive organic

products as well as less associated plastic packaging and fewer meat purchases.

Over 38 school weeks, a weekly 2-h seminar subject on the topic of healthy eating was offered in the upper school of the grammar school, for which 12 students had registered. These students are between 17 and 20 years old. A computer room and a large kitchen with three kitchenettes were available. The aim was to create and prepare wholesome recipes, which should be summarised in a cookery book with their own illustrations, published in the school magazine, and offered in the break catering at the kiosk. The ideas and wishes of the students were collected in a brainstorming session, and it was decided to develop recipes for snacks. Salads, dips, wraps, sandwiches, baked goods, desserts, and shakes were to be created. Firstly, extensive research on the internet was carried out, with each group selecting a recipe from six given areas, which could be modified individually. There were three cooking groups, each with four students. The roles of group leader and buyer changed every week. Each cookery group planned and performed the shopping on the day before and brought the ingredients for cooking to school. All recipes were calculated for four people. The teacher provided instruction in kitchen hygiene. The students decided that the four groups should prepare the recipes each week so that all students would always receive a balanced and healthy meal.

A dip was always offered with a baked good. If a recipe was not successful, it was modified and prepared again the following week. Seasonal planning was welcome, for example, students decided to bake cinnamon waffles before Christmas, which were sold to students and teachers to fill the graduation fund for the graduation ceremony. All recipes were documented by the respective group in the group file, and the respective cooking results were photographed with a camera. Care was taken to ensure that the illustrations were attractive. The work in the test kitchen was completed after 32 weeks.

A print format template in DIN A4 landscape was created in the plenary session and each group inserted information about the ingredients and preparation, supplemented by illustrations. A publisher was found to print the cookery book at a price of less than €7 so that the measurable result was not only an electronic but also a printed version. The cookery book had a large spiral binding and a hard cover so that it was easier to turn and place upright when selecting recipes. Special care was taken to ensure that the double-sided printed pages were made of sturdy, washable paper. The correction, visual adaptation, and design of the cover and the recipe overview took 6 lessons. A title for the cookery book was determined. The achieved milestone was the sale of the cookery book (Figure 2) to students and teachers.

3.4 | Complex-To-Implement Project *Forest Classroom*

The project *Forest Classroom* was mainly associated with SDG 4 'Quality Education', but also took into account SDG 15 'Life on Land', SDG 10 'Reduced Inequalities', SDG 5 'Gender Equality', SDG 3 'Good Health and Well-being', and SDG 11 'Sustainable Cities and Communities' (access to green spaces). One of the main aims of the forest classroom was to create an

extracurricular learning space where students can experience and explore nature and learn at the same time. Theoretical learning content was intended to be transferred to practical and real-life situations in a new setting.

The project was planned for 2 years. In the first year, preparations for the project began. The organisational framework and communication with the potentially involved partners took place. The project was initiated by the city, which specifically approached the school. Following an internal evaluation, the school decided to include a forest classroom in its educational programme, realised in cooperation with the town, the former forester, and the forest. The forester was responsible for coordination and communication with the township (mayor, building authority) and external organisations such as Saarforst, tradesmen, and craft firms. The necessary framework conditions for the extracurricular learning location were evaluated and a section of the city forest suitable for the project was selected together with the city. It was important for the school that the forest classroom was within walking distance of the school. The school-internal project group was in close contact with the partners and not only supported the students with the pedagogical processing of the project but also accompanied it on-site and actively worked together with the learners and the cooperation partners on its implementation.

In the second year, the project was implemented. A responsible project team was determined within the school, and the group of students was identified who were to work on the construction. The school form of training preparation was chosen as the high proportion of practical work in this phase strengthens the vocational orientation of a socially disadvantaged learning group. These students were mostly still minors aged 16–17, and many had a migrant background. Language problems were the main issue. The goal of this vocational preparation was to obtain a secondary school leaving certificate. The students were taught by vocational preparation teachers and started to work together with the partners. Building the forest classroom was the main project, which was followed by smaller sub-projects for the design and utilisation of the forest classroom. The forest classroom and the associated projects were designed to encourage active participation, in which the learners also tackle and plan themselves. The authentic learning environment was designed to give learners a deeper understanding of nature and environmental protection. After initial measurements, part lists, and material requirements were compiled. Parallel to the organisational preparations, the former forester contacted various trades, the forestry department, and various craft businesses to support the project. The site was cleared, and trees were felled. Once the forest site had been prepared, the felled trees were processed to prepare components for the construction. Forestry work such as felling, storing, and debarking was carried out with the apprentices. The next step was to lay the concrete foundations and work on the components together. This was followed by the assembly of the hut and the subsequent topping-out ceremony. The construction of the forest classroom as a sustainable extracurricular learning centre located within 10 min of walking distance was finished. It was created with seating, blackboards, and teaching materials that can be used by a wide variety of learning groups in the long term (Figure 3).



Schichtjoghurt

Zutaten:

- o 500 g Naturjoghurt (3,5%)
- o 1 TL Honig
- o 8 EL Haferflocken
- o Nüsse nach eigener Wahl
- o 1 Handvoll (ca. 150 g) frisches Obst (Himbeeren und Blaubeeren)

 10 Minuten

Zubereitung:

1. Obst waschen und verlesen.
2. Joghurt mit Honig verrühren.
3. Ein Drittel des Joghurts gleichmäßig in Gläser verteilen.
4. Anschließend 2 EL Haferflocken pro Glas darauf verteilen und die zweite Schicht Joghurt draufgeben.
5. Zum Schluss das Obst und die Nüsse obendrauf platzieren.



18

Paprika-Feta Dip

Zutaten:

- o 1 rote Paprika
- o 1 Knoblauchzehe
- o 100 g Feta-Käse
- o 70 g Bio-Naturjoghurt (3,5%)
- o ½ TL Oregano
- o 1 TL Olivenöl
- o Je 1 Prise Pfeffer und Rohrzucker

 45 Minuten

Zubereitung:

1. Backofen auf 250°C (Ober-/Unterhitze) vorheizen und Backblech mit Backpapier auslegen.
2. Paprika waschen, aushöhlen und vierteln.
3. Paprika in den Ofen geben und so lange garen bis die Haut leicht angebräunt ist.
4. Paprika abkühlen lassen, Haut abziehen und in grobe Stücke schneiden.
5. Knoblauch schälen, zerkleinern und Feta in grobe Stücke schneiden.
6. Alle Zutaten in einen Mixer geben und gut durchmischen.
7. Mit Pfeffer, Zucker und Olivenöl würzen.

FIGURE 2 | Measurable delivery of the project Healthy Snacks: Cookery book *Staying Healthy at School and University* (book consisting of 32 pages).

A discarded shipping container was integrated into the forest ecosystem to be used as a storage room for furniture, equipment, and teaching materials. The toilets in the neighbouring sports hall could be used, which did not require any additional installations. An associated school garden sub-project was started, for which students were jointly responsible for harvesting and caring for the plants. By working in the garden, the students gain practical experience in growing and caring for plants to anchor healthy eating and sustainable agriculture firmly in their consciousness. This will motivate and contribute to a better understanding of lessons on biology, nutrition, and the complex networks in nature and the environment. All this made the forest classroom and the associated garden a safe, functional, and attractive place to learn.

The forest classroom offers great potential for interdisciplinary teaching. With the help of various pedagogical tools (e.g., learning diaries, experiments, soil sample analyses, and movement-oriented games), different learning groups were offered an outdoor learning programme that not only combined different vocational and general education subjects but also integrated the topic of climate protection in various facets. For example, information trails with various information boards were created on the site. The boards were differentiated so that different learning groups benefited from them. For example, the development cycle of the fox tapeworm is described in detail on one page of the display panels. This is important for the topic of parasitism in upper school biology lessons. The reverse side of the display board contains information about the forest ecosystem and its animals. This topic is interesting for the middle school. Further learning stations were planned and integrated for various subjects such as biology, music, and foreign languages. Outdoor learning not only promoted physical health but also encouraged a variety of learning content to be transferred from the classroom to nature. This allowed to be explained and experienced vividly, directly on site, and on a real object, which makes content and learning more tangible and therefore more sustainable for the learners.

As a special feature, in addition to experiencing and linking the learning content itself, a milestone was also set in the direction of vocational orientation. The planning and organisation were deliberately shifted to pre-vocational training. It aimed to promote and impart a sustainable vocational orientation to prepare students for starting an apprenticeship or profession. It was intended to encourage young people who have had little success in their previous school careers. Practical relevance (Bilgram and Viehöfer 2020) is therefore of great importance. The students taking part in the project were directly involved in the planning and realisation and gained extensive knowledge about the theoretical content of the construction project. Through direct contact with the partners, the students were able to bridge the gap between theory and practice and actively participated in the practical realization. This not only promoted individual inclinations and talents but also social and human skills.

4 | Discussion

The commitment, knowledge, and skills of teachers remain crucial in the certification process despite the wealth of information and resources on possible sustainability projects provided both by the Ministry and on the Internet. These resources provide

a solid foundation and many ideas, but it is the teachers who integrate these projects into everyday school life and make them alive and tangible for students. In this way, schools can become places where sustainable development is not only taught but also lived. In this school development process, the school space becomes a central place for changing society towards sustainability, with teachers playing an important role as multipliers and students gaining awareness for sustainability. The change towards greater sustainability at a school is associated with and driven by a change in education style, individual behaviour, deadlocked ways of thinking, reflection on values, the discovery of team spirit, new types of commitment, and future prospects, as evident from the following examples.

All projects must be approved in advance by the school administration and meet the certification guidelines. The SMART individual goals were evaluated using the four-eyes principle (Supporting Information S3). The four-eyes principle means that a second person reviews a decision, assessment, or control. The goal is to avoid errors, increase objectivity, and create transparency (KDZ—Center for Administrative Research 2025).

4.1 | Evaluation of the Project *Healthy Snacks*

The project *Healthy Snacks* was submitted to the school administration as a seminar subject (2h per week) and the SMART method was discussed in relation to the project during a meeting. Applying the SMART method to the healthy eating project, resulting in a cookery book, provided a structured way of setting clear and achievable goals. The specificity was given, as the specific goal to run a healthy eating cookery course and produce a cookery book ensured that all students had the same vision. This minimised misunderstanding and helped to concentrate on the essential content. Nevertheless, there were occasional difficulties, for example, when students did not listen properly when the teacher announced sub-objectives. The measurability was given, as the success criteria were defined by concrete indicators such as the number of recipes prepared, the feedback from students on the cookery course, or the quality and completeness of the cookery book. This made it possible to objectively assess progress and the final result. Sometimes the learning success or creativity of the students was difficult to quantify. A combination of qualitative methods such as feedback and quantitative indicators such as the number of finished recipes was able to compensate for this. The attractiveness or achievability was given, as the goals were designed in such a way that they motivated the students without overstraining them. The reasonableness or relevance was given, as the achievement was highly relevant for students, that is, it was not only meaningful in terms of content but also promoted important skills such as nutritional education, teamwork, and creativity. The time-boundness was given, as the project was completed in time for the school year, and the goal was achieved.

Integrated practical learning opportunities promote a holistic education. The healthy eating project was a valuable addition to regular school lessons. It was an exciting and instructive experience and showed the students that healthy eating is not only important but can also be simple and delicious. They not only learnt new culinary skills but also developed a deeper



FIGURE 3 | Measurable delivery of the project *Forest Classroom*: The building under construction and completed.

understanding of healthy eating and its importance in everyday life. Theoretical knowledge about healthy eating, which the students acquired in the subject lessons of health, was put to practical use. Their understanding of macro- and micronutrients was deepened by having to consider these principles directly when preparing meals. Students were able to demonstrate their creativity and problem-solving skills by preparing snacks independently. They learned to adapt the recipes they had chosen and improvise when certain ingredients were not available. The project encouraged cooperation and communication between the students. In small groups, they had to distribute tasks, coordinate, and find solutions together, which strengthened their teamwork skills and demanded initiative. A key aim of the project was to raise awareness of healthy eating. Students were already intensively involved in the selection and combination of ingredients when shopping to create balanced and nutritious snacks. This led to a critical examination of their eating habits and motivated many to make healthier choices. In the end, the students had the opportunity to reflect on their experiences and give feedback. Many were positive about the practical approach and highlighted that they had learned a lot about healthy eating. The reflection also helped them to better understand the importance of snacks for their concentration and performance in everyday school life. The course had the potential to have a long-term positive impact on their dietary behaviour. By learning to prepare healthy and tasty snacks themselves, they were encouraged to make conscious nutritional choices in the future and inspire their families.

Despite these positive experiences and the enthusiasm for the cookery course, some students expressed the problem that they would probably not be able to implement the newly learned eating habits at home. Old habits are deeply ingrained, and it takes effort to break them. Changing diet requires discipline and perseverance. This is particularly difficult if the whole family is not pulling in the same direction. At home, parents often decide what to buy and how to prepare meals. If the parents themselves do not practice a healthy and sustainable diet, it is difficult for the students to implement their new knowledge. Sometimes, parents also lack the understanding or willingness to change their eating habits. Without support and encouragement from the family environment, motivation can quickly wane. The daily grind and convenience can revive old habits. Some students complained about higher shopping costs. Healthy and sustainable food can be more expensive and harder to find than unhealthy alternatives. A wholesome and sustainable diet often requires more time to plan and prepare meals. Due to a lack of time, many families prefer to resort to quickly prepared ready meals, which are often healthier and lead to obesity and diet-related diseases (Mazzocchi et al. 2022).

The compilation and printing of the cookery book was a success. Creating their own book gave them a sense of pride and self-efficacy. Thanks to the knowledge and recipes, the students now have the tools at hand to create healthy snacks in the future. This supports the intention of sustainability. The creation of the cookery book promoted media skills as well as the use of digital tools and software for text and image editing. Many students and teachers bought the visually appealing cookery book for themselves and as a gift. The recipes were presented to the tenant of the kiosk and cafeteria with the hope that in the future

more and more healthy salads and wraps will be offered by purchasing sustainable (i.e., organic, regional, and seasonal) food. Offering sustainable and organic school food is of high importance (Batistela dos Santos et al. 2022; Bauer and Morlock 2024).

4.2 | Evaluation of the Project *Forest Classroom*

The SMART method provided a helpful framework for clearly structuring and gradually implementing the project *Forest Classroom*. The specificity was given, as the project goal was the construction of a roofed wooden house in the forest. The tasks from felling the trees to building the forest classroom were concrete, which helped everyone involved to recognise the direction and scope of the project. Nevertheless, there were sometimes unclear task allocations and communication problems, which were resolved through regular planning meetings. The measurability was given, as the progress was documented and monitored through specific milestones such as the cutting of the trees, completion of the basic construction, and installation of the roof. The commitment of the students and the quality of the work could also be made measurable through feedback or regular reflection. The attractiveness was given, as the involvement of numerous sponsors (such as the city, forest, forester, craft companies, and teachers) made the project both motivating and realisable. The students experienced practical work and developed skills that delivered tangible results. Regular interim targets, which visibly demonstrated small-scale progress, helped to minimise any potential loss of motivation. The reasonableness was given, as the project was particularly relevant for the school-based form of vocational training preparation, as it promoted ecological education, manual skills, and teamwork. It also addressed social values such as sustainability and a sense of community. Comprehensive safety instructions and supervision by specialists such as the forester reduced risks. Early material planning and the involvement of supporters and sponsors secured the necessary resources. The time-boundness was given, as the time frame was set at 2 years, which enabled continuous planning and implementation. This time limit helped to monitor progress and achieve milestones on time. Nevertheless, there were weather-related delays that had to be made up for.

The project showed that the participating students took a concrete step forward in their career orientation through the project and direct contact with various professions such as forester, carpenter, concrete worker, etc. Not only did their inclinations develop during the project, but their self-image also changed favourably. The previously frequently assumed role of the disoriented young person changed for many students. Many of them realistically concretised their career plans for the future. Some of the learners stated that they would like to take up one of the above-mentioned professions in their professional future and have already taken steps to actively look for a job. In addition to combining theoretical and practical knowledge in the setting of this unusual school location, other projects centred around the forest classroom focus in particular on teaching vocational skills. In addition to the subject-specific learning content, the students should also gain their first impressions of the professional practice of the partners involved in the project. Through practical and sensory experiences, they should develop their first professional inclinations

and interests and deepen these in the form of joint and individual tasks.

The most substantial finding of the project was that the students became more active and engaged and were able to develop further their potential and decision-making skills in their respective roles as supportive and indirectly involved actors. The students moved from the passive student role, which many students in this type of school like to take on, into the active role of craftsmen and foresters. It was noticeable how the group of students became absorbed in their tasks through their participation in the process and the high proportion of practical work, and how they freely engaged in activities outside of school according to their inclinations. This involvement, participation, and co-determination of the students is participation in action (Holst and Hantke 2024). Observing this development motivated teachers to bridge the gap between theory in the classroom and practice or nature. The sensory experience associated with the forest classroom and the change in the setting itself brought about major changes in the learning groups.

Since less than a quarter of young people see themselves as able to make an effective contribution to solving sustainability problems through formal education (Grund and Brock 2022), this forest project made a difference and taught the students that it is possible to live sustainably. As further references to sustainability are still most likely to appear in the context of related subjects such as geography, biology, health, economics, and politics, this project contributes to the establishment of a cross-cutting anchoring of sustainability (Grund and Brock 2022). In the future, the forest classroom will be an integral part of the curricular and pedagogical work and thus occupy a place in the timetable of many classes and forms of school. Further subjects will be established, and teachers will have the opportunity to choose the forest classroom as a methodically meaningful learning space for their student groups. Implementing a forest classroom is an ongoing process that requires constant evaluation and development. The school community should regularly evaluate the success of the forest classroom, gather feedback, and make adjustments to ensure it meets student needs and is successful in the long term. In addition, the care and maintenance of the forest classroom are critical to its long-term success. Students should learn to share responsibility for caring for it, cleaning it, and performing maintenance.

Some current drawbacks can be solved in the future. One of the main drawbacks of a forest classroom is that it can be used predominantly in the warmer months. In the spring and summer, temperatures are pleasant, and students can learn outdoors without major restrictions. Nature is particularly lively during this time, offering a wealth of learning opportunities, such as observing plants and animals, conducting ecological experiments, or simply learning a specialized lesson in a pleasant forest atmosphere. In autumn, the forest classroom can also be used as long as the weather conditions remain mild. However, the weather becomes more unpredictable, and frequent rainfall can make it difficult to use. Damp ground and wet leaves increase the risk of slipping, which can pose a safety risk. During the winter months, the use of a forest classroom is severely restricted. Cold temperatures, snow, and ice make it uncomfortable and sometimes

dangerous to spend long periods outdoors. Students and teachers would have to dress warmly, which can affect freedom of movement and concentration. In addition, teaching materials and equipment such as tablets could be damaged by moisture and cold. Aside from weather conditions, other factors can affect the use of a forest classroom. For example, insects such as mosquitoes and ticks can be a problem in the warmer months and make being in the forest unpleasant or even risky to health. Pollen allergies can also cause discomfort in some students and affect lessons. The duration of daylight is another important aspect. During the short winter days, natural light can arrive later or disappear quickly, reducing the time spent learning outdoors. Forest classroom lessons require sufficient daylight to work effectively and see the surroundings well.

The level of engagement among students was rated very high in the projects discussed, which was reflected in good to very good grades on their report cards. These grades may not be published in detail, but they also include behaviour and knowledge in the area of sustainability. In the German school system, the 15-point grading system is used in the upper secondary school level. Performance in the project *Healthy Snacks* increased from an average grade point of 8.5 (satisfactory) to 12 (good) over the course of the school year, representing a substantial improvement. Regarding the potential for scalability of the 'Healthy Snacks' project, it should be noted that the project cannot be expanded to a higher number of students because the kitchen space is limited. In the project *Forest Classroom*, the average grades increased by one level due to the students' commitment and strong motivation. The project *Forest Classroom* will be a topic every year, as it concerns the care and maintenance of the forest classroom.

4.3 | Transformative Potential of School Education

The effectiveness of project-based learning as a method for actively involving students in learning processes was explained by the motivational nature of projects based on real-world problems (Almulla 2020). This was an important finding for school sustainability projects such as the projects *Healthy snacks* and *Forest Classroom*. Project work can promote a high degree of personal responsibility, creativity, and problem awareness. However, the question arose as to how success was defined and measured in such studies. It must be assessable who actually participated actively in the project and who did not.

The focus was often laid on short-term learning effects or motivational gains such as a boost in motivation or better test results (Rieckmann 2024). It was less often examined whether these changes were long-lasting or led to a sustainable change in behaviour because such studies involve considerable effort to observe sustainable changes in behaviour or personality development of students monitored over longer periods of time—often beyond their school years. The time students spend in secondary schools is limited because they often attend certain school types for only 2–3 years. Hence, teachers are not able to track their development systematically over a longer period. In addition, sustainable developments and long-term behavioural changes or attitudes are difficult to quantify objectively due to the multilateral influences and thus methodological difficulties.

However, this long-lasting dimension would be particularly important for the evaluation of school sustainability projects to answer the question of whether a one-time project is sufficient, or a long-term school structure is required, or a repetition to have a lasting effect.

Despite systematic and methodological difficulties in measuring long-term effects and sustainable changes in behaviour, project work is an essential component of ESD. Even in short-term projects, it opens up learning spaces in which technical knowledge, value-oriented thinking, and concrete action are linked—and it is precisely this connection that is crucial for a sustainable society. The transformative potential of school education, when taking into account underlying social conditions, was recognized as an overarching aspect of 'ESD for 2030' (Reimers 2024). With regard to SDG 10 (Reduced Inequalities) in particular, it becomes clear that educational projects are particularly relevant when they systematically promote justice, for example, through barrier-free offerings, cultural participation, or the targeted inclusion of disadvantaged groups. The project *Forest Classroom*, providing access to nature and making environmental education tangible, can serve as such an inclusion example as discussed. Such sustainable school projects are transferable to schools with sufficient equipment, committed leadership, dedicated staff, or favourable locations that are able to carry out such projects. The risk of unintentionally reinforcing existing educational inequalities must be minimized.

4.4 | Certification Process

The school was visited by the jury of the ministry's certification process after the first year. The 17 SDGs had to be met in various school areas. The jury was impressed by the diverse projects and actions and the planning of future projects in the field of ESD (Figure 1). After the second year, the certification took place with a ceremonial presentation of the certificate. Sustainability projects are now an essential part of school education, as they teach students important knowledge and values to protect the environment and promote a sustainable lifestyle. The hypothesis that the key to a holistic approach to school development lies in the development of an evidence-based implementation model with project measures in line with the 17 Sustainable Development Goals (SDGs), which are categorised according to low, medium, and high content and organisational complexity, has been fulfilled.

4.5 | Selfless Commitment of Teachers as Key

The success of sustainability projects depends largely on the commitment of the teachers and the available financial resources (Teichert Volker 2023). Teachers who are enthusiastic about sustainability and are willing to invest time and energy beyond regular class time can drive such projects forward decisively (Sinakou et al. 2023). Lack of motivation, commitment, and lack of knowledge and ideas on the part of teachers can lead to projects stagnating or even failing. A quantitative study showed that there are large gaps in the qualification of teachers in the area of sustainability, as two-thirds of German teachers have never been confronted with the topic of ESD during their

studies and a further 22% have rarely been confronted with it (Grund and Brock 2022). Many teachers do not feel adequately prepared to support their students in developing the skills needed for a more sustainable future (Parry and Metzger 2023). According to a survey of school principals (Anders 2024), the greatest challenges in promoting sustainability and ESD in schools are a lack of time and staff (72%), prioritization of other demands on the school (71%), lack of financial resources (54%), and a strong focus of everyday school life on examinations and performance targets (40%).

Teachers who engage beyond the classroom create an inspiring learning environment. These additional activities are time-consuming and often require a high level of personal commitment, as they cannot always be integrated into regular working hours. This engagement beyond regular classes is not only time-consuming but also emotionally demanding. Teachers who are committed to sustainability must remain motivated, even when they encounter obstacles or suffer setbacks. They must be able to inspire and motivate their students to become active and take responsibility. Often it is about achieving a deep understanding and a sustainable change in behaviour among students, which is a challenge that requires patience and perseverance. Teachers who do not have the motivation or interest for such commitment can severely hinder the progress of sustainability projects. If the necessary enthusiasm is lacking, projects are often only implemented half-heartedly or neglected altogether. Students sense this reluctance and lose interest. Sustainability projects can quickly lose momentum and fizzle out in their impact. In addition, such an attitude can also affect the entire school climate and reduce the general willingness to commit to sustainable goals. Support and recognition of committed teachers, including by school management, are therefore of great importance (Cebrián et al. 2022; Dunlop et al. 2022; Forssten Seiser et al. 2023; Gericke 2022; Mogaji and Newton 2020). Schools should create frameworks that make it easier for teachers to get involved in sustainability projects beyond the classroom. This includes training, the provision of resources, and especially a culture of appreciation and support. Collaboration with colleagues and the exchange of ideas and best practices can also help to keep motivation high and successfully implement sustainability projects (Remy 2023). This is very important because teacher training in ESD was rated as the worst in most educational sectors (Holst et al. 2024).

Teachers play an indispensable role in teaching the concepts of sustainable development and putting them into practice. Their ability to explain complex issues understandably and to demonstrate the relevance of sustainable development in everyday life is crucial to success in learning. This is about imparting theoretical knowledge, promoting practical skills, and a deep understanding of the challenges and solutions in the field of sustainability. The commitment of teachers is a key factor. Teachers who are passionate and committed to sustainability can inspire and motivate their students to get actively involved. They act as role models and multipliers who show what sustainable action can look like in practice and what positive effects it has on the environment and society. Furthermore, the competence of teachers in the area of sustainability is crucial. A sound education and regular training enable them to nourish students with the latest scientific findings and pedagogical methods. This

enables them to design high-quality educational offerings that promote both the transfer of knowledge and the development of skills and attitudes in the sense of sustainable development. Only through the active participation and continuous training of teachers can sustainability projects be successfully implemented and sustainably anchored in the school culture. This requires not only individual commitment and organizational talent but also the support of the school management and educational policy to provide the appropriate framework and resources.

The role of teachers as key players in the transformation process towards greater sustainability in education was rightly emphasized (Rieckmann 2024). Their commitment was often the driving force behind internal school changes (change management) and pedagogical innovations. A critical examination of the structural conditions under which teachers operate is needed. Systemic educational conditions in particular (which are strongly focused on performance comparisons, standardization, and results orientation) can marginalize sustainable development. For example, if social skills (such as reflective thinking, participation, or interdisciplinary thinking) are rarely included in exam formats and curricula, the space for sustainability-oriented educational approaches may be limited in everyday school life. To be effective, sustainable education must not only be considered an additional learning objective, but also be anchored as an integral part of the education system (Reimers 2024). This calls for policy recommendations that go beyond voluntary certification. Curricula would have to be reformed, exam formats adapted, and further training opportunities for teachers strengthened to systematically promote sustainability. In addition, schools should be structurally supported with resources, project work periods, and the anchoring of ESD in school law. This way, teachers are serious actors capable of taking action within a supportive system.

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Ethics Statement

The research did not involve human participants and/or animals.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The research findings presented in this study are supported by data included in the main text.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Data S1:** Supporting Information.

Supplementary information

Sustainable Schools – Changing Society

Towards Sustainability

Content

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Information S1. Project-based learning exemplified by two projects

Project-based learning is a quantitative method that was carried out in six phases. The manuscript describes two projects: Healthy Snacks and Forest Classroom. Although project-based learning is often accompanied by qualitative methods, a quantitative methodology can be systematically integrated with targeted planning.

***Healthy Snacks* project**

The following quantitative methodology was used in the *Healthy Snacks* project.

1. Question and answer session: before/after on the following topics

- Knowledge questions: on healthy eating, food, hygiene rules in the kitchen
- Attitudes: towards sustainability, meat consumption, wholefood nutrition
- Self-assessment: I can independently implement or modify a recipe using wholefood ingredients.

2. Evaluation feedback

Students evaluate verbally the project on a scale (good, average, and poor) and raise cards:

- How well were you able to participate?
- How healthy do you think the cooked dishes are?
- Was shopping problematic?

3. Teacher's observation sheets

Teacher observes

- Were all steps carried out correctly?
- Was the recipe followed?
- Was the team working together?

→ Results were recorded as a grade.

4. Consumption measurement and leftover analysis in plenary session

- How much of the ingredients were used?
- How much waste was produced?

5. Comparison groups in plenary session

The same recipe is prepared in all kitchens.

Then, the results are compared and tasted.

6. Self-assessment scales

Students assess verbally their cooking skills before and after the project (yes, medium, no) and raise cards

- I can choose a recipe on the topic and modify it to make it wholesome.
- I can shop cheaply and healthily.
- I can put together a healthy meal plan at home.

Forest classroom project

At first glance, the *forest classroom* project appears to be practical and creative, but it offers many points of reference for quantitative methodology.

1. Before-and-after survey

The evaluation was orally as students had problems with the German language. Nature-related knowledge was asked, *e. g.*, what tree species are found in the surrounding area? Which tree species is the wood for the forest classroom cut from?

Self-assessment scales:

- I enjoy working outside.
- I can use tools.
- I am familiar with sustainable wood use.

2. Teacher observation sheets

Teacher observes

- Were all work steps carried out correctly?
- Was the work done as a team?
- Was the work carried out with commitment?

→ Results were recorded as grades.

3. Competence grid (quantifiable)

Predefined performance levels, e. g.,

- Planning competence
- Tool mastery
- Teamwork skills

→ Assessment with grades from 1–6

4. Project-related performance measurement

- Learning assessments: on forest ecology, sustainability/climate change, construction (mathematics, technology) → practise and calculations.
- Format: short answers → quantitatively evaluable.

5. Measure resource and material consumption

- Wood consumption, working hours, cost shares → evaluable
- Comparison: how economically was the work carried out?

6. Satisfaction surveys in plenary with show of hands

Evaluation of the project after completion:

- How satisfied are you with the result of the forest classroom?
- How meaningful was your role in the team?

Information S2. Explanation of the categorization in Table 1

Easy to implement – green dot

Choice of topic

- Simple, clearly defined topic with everyday relevance.
- Materials easily accessible.

Time required

- Can be implemented at short notice (1–2 weeks).
- Low time requirement, can also be integrated into lessons.

Organisation and teamwork

- Small groups or individual work sufficient.
- Task distribution uncomplicated.

Teacher supervision required

- Minimal support required.
- Students work largely independently.

Moderately difficult to implement – orange dot

Choice of topic

- Somewhat more complex topic with several aspects.
- Here: Making healthy snacks

Resource requirements

- Requires a kitchen including equipment and a computer room.

Time required

- Medium-term time frame (3–6 weeks)
- Here: Seminar subject, 2 h per week, one school year: Healthy snacks, shopping in the students' free time

Organisation and teamwork

- Teamwork required, clear distribution of roles
- Regular coordination within the group.

Supervision required by teachers

- Regular monitoring of interim results.
- Assistance with sources, structure or technology required

Complex to implement – red dot

Choice of topic

- Multifaceted, interdisciplinary or socially relevant topic.
- Here: Setting up a forest classroom.

Resource requirements

- Cooperation with external partners or experts, special technology (tree cutting machine, *etc.*)

Time required

- Long-term planning (several months to years).
- Integration into project weeks or extracurricular activities.

Organisation and teamwork

- Large group work or cross-project teams.
- Project management required → schedules and work packages with school management, city, foresters, craft businesses and teachers.
- Sponsors

Supervision by teachers

- Intensive support and coordination, feedback phases, support with project structure, research, reflection and presentation at the inauguration.

Information S3. SMART single-goal evaluation with the four-eyes principle

1. Goal definition by the first person (e. g., project manager):

The goals are formulated according to SMART principles.

2. Cross-check by a second person (School management):

This person checks whether each criterion of the SMART method is met.

They can ask the following questions:

- Is the goal clearly and specifically formulated?
- Is it measurable (e. g., reports)?
- Is it attractive and motivating for the project team?
- Is it realistic given the available resources and timeframe?
- Does the goal have a specific deadline?

3. Discussion and optimization: If the second person identifies weaknesses (e. g., a goal is too vague or not measurable), the goal is revised together.

4. Documentation and approval: After mutual agreement, the goal is documented as

5. ZUSAMMENFASSUNG

Schulen sind nicht nur Bildungsorte, sondern auch wichtige Akteure im gesellschaftlichen Wandel. Besonders die Förderung gesunder Ernährungsgewohnheiten und nachhaltiger Strukturen spielt in der Schulentwicklung eine zentrale Rolle. Für eine erfolgreiche Umsetzung braucht es wissenschaftlich fundierte Konzepte und die Zusammenarbeit aller Beteiligten. Schulkioske haben großen Einfluss auf das Essverhalten von Schülern. Trotz der bekannten Bedeutung gesunder Schulverpflegung fehlen oft konkrete Daten und erprobte Umsetzungsmodelle. An einem Berufsbildungszentrum wurden das Ernährungswissen, -verhalten und Kaufverhalten der Schüler untersucht. Auf dieser Grundlage entstand ein Kiosk-Konzept nach den Standards der Deutschen Gesellschaft für Ernährung. Eine neue Wohlfühl-Lounge in der Cafeteria unterstützte das veränderte Konzept. Dies besitzt Modellcharakter und kann als Grundlage für vergleichbare Initiativen an anderen Schulen dienen. Damit schließt diese Studie eine Forschungslücke im Bereich gesunder Schulkiosk und die erprobten Maßnahmen bieten ein übertragbares Beispiel für eine erfolgreiche Umsetzung im schulischen Alltag. Dieses Modell sollte auch im Zertifizierungsprogramm von Schulen verankert sein. Parallel zur Ernährungsförderung gewinnt die nachhaltige Schulentwicklung zunehmend an Bedeutung. Bildungseinrichtungen spielen eine Schlüsselrolle bei der Integration von Nachhaltigkeitsprinzipien in den Alltag und wirken als Multiplikatoren für den gesamtgesellschaftlichen Wandel. Die Umsetzung von Nachhaltigkeit in Schulen ist ein ganzheitlicher Prozess, der langfristige Veränderungen im Schulalltag erfordert. Bislang fehlt eine flächendeckende Integration, da der Zertifizierungsprozess zur „Schule der Nachhaltigkeit“ meist freiwillig ist. Die Forschungsstudie liefert Argumente und Handlungsvorschläge, die zur Weiterentwicklung bestehender Nachhaltigkeitskonzepte anregen und den bisherigen Diskurs um praxisorientierter Perspektiven erweitern. Die Erkenntnisse stärken die Motivation zur aktiven Gestaltung nachhaltiger Bildungsprozesse und können somit als Referenzrahmen für weitere Bildungsprojekte genutzt werden. Die Forschungsergebnisse verdeutlichen, wie Partizipation im schulischen Kontext erfolgreich gestaltet werden kann. Die entwickelten Ideen bieten innovative Impulse für andere Bildungseinrichtungen und fördern eine Kultur der Vielfalt und Mitgestaltung.

6. SUMMARY

Schools are not only places of education, but also important players in social change. Promoting healthy eating habits and sustainable structures plays a particularly central role in school development. Successful implementation requires scientifically sound concepts and the cooperation of all stakeholders. School kiosks have a major influence on pupils' eating habits. Despite the well-known importance of healthy school meals, concrete data and proven implementation models are often lacking. The nutritional knowledge, behaviour, and purchasing habits of pupils at a vocational training centre were examined. On this basis, a kiosk concept was developed in accordance with the standards of the German Nutrition Society. A new feel-good lounge in the cafeteria supported the changed concept. This serves as a model and can be used as a basis for similar initiatives at other schools. This study thus closes a research gap in the area of healthy school kiosks, and the proven measures offer a transferable example of successful implementation in everyday school life. This model should also be anchored in the certification programme for schools. Parallel to the promotion of nutrition, sustainable school development is becoming increasingly important. Educational institutions play a key role in integrating sustainability principles into everyday life and act as multipliers for change throughout society. Implementing sustainability in schools is a holistic process that requires long-term changes in everyday school life. So far, there has been a lack of comprehensive integration, as the certification process for 'sustainable schools' is mostly voluntary. The study provides arguments and suggestions for action that encourage the further development of existing sustainability concepts and expand the current discourse to include practice-oriented perspectives. The findings strengthen the motivation to actively shape sustainable educational processes and can thus be used as a frame of reference for further educational projects. The documented studies illustrate how participation can be successfully designed in a school context. The ideas developed offer innovative impetus for other educational institutions and promote a culture of diversity and co-creation.