

  
Youth health from a  
holistic perspective

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## Executive Summary

This deliverable presents the functional specification framework for the YEAH! digital system. It defines the structural, methodological and operational principles required to support the implementation of the intervention and the scientific analyses conducted within the project. The document provides a shared reference for all partners involved in the design, development and deployment of the application, ensuring consistency across work packages and alignment with regulatory, pedagogical and scientific requirements.

The specification describes the roles and responsibilities of the intended user groups, the guiding principles underpinning the architecture, the processes governing provisioning and onboarding, and the mechanisms enabling activity monitoring, data restitution, notifications and data export. The framework also integrates constraints related to GDPR, data protection, hosting, security and open-science commitments.

The deliverable does not prescribe technical implementation choices but establishes the functional foundations necessary to guide development and ensure coherence in preparation for large-scale deployment and scientific evaluation.

## Overview

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## Abbreviations

BLE	Bluetooth Low Energy
CSV	Comma-Separated Values
DPO	Data Protection Officer
FAIR	Findable, Accessible, Interoperable, Reusable
GDPR	General Data Protection Regulation
JSON	JavaScript Object Notation
PA	Physical Activity
PRF	Participant Reference File
RCT	Randomised Controlled Trial
SB	Sedentary Behaviour
WP	Work Package

## 1. Introduction

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### 1.1 Project Overview

Empowering children and adolescents to adopt healthy lifestyles while tackling health inequalities is crucial. Person-centred interventions have been developed to this end but face several challenges: they are often restricted to one specific actor of children's environment (teachers, parents, or peers) and rarely target several significant others simultaneously, they are often restricted to one specific behavior (e.g., physical activity) or life domain (e.g., school), their effectiveness may differ according to socio-economic or socio-spatial conditions, and they are rarely both largescale and personalised to individuals' needs. To address these challenges, the ambition of YEAH! is to develop an innovative personalised person-centred digital intervention that: (1) promotes children (8-10 years) and adolescents' (14-16 years) social interactions with multiple actors of their environment, (2) targets multiple health behaviors (physical activity, sedentary behaviors, diet, sleep), (3) combines in a novel manner evidence-based knowledge of optimal intervention features (theory-driven approach), with co-creation with end-users and stakeholders (data-driven approach) to tailor the intervention to the local context and target group, and (4) relies on a state-of-the-art method of intervention development to rigorously measure and verify its impact, optimise its sustainable implementation in the community and its equity, and evaluate its cost-effectiveness. To do so, YEAH!, will articulate interdisciplinary methods and concepts from psychology (health, social, developmental), public health, psychiatry, social marketing, geography, geomatics, environmental epidemiology, IT and computer sciences, statistics, physiology, and medicine, and on the participation of stakeholders (children and adolescents, parents, teachers, healthcare professionals, educators, local and national authorities).

### 1.2 Purpose of the deliverable

This document is part of WP3 and establishes the functional framework required for the development, deployment, and validation of the YEAH! digital system. It provides a clear, shared, and structured conceptual foundation for all partners involved in designing, developing, and operating the project's digital infrastructure. This framework aligns scientific expectations, regulatory requirements, operational needs in educational and family settings, and the long-term development trajectory foreseen for the tool throughout the duration of the project.

The purpose of this document is to establish a clear and comprehensive functional architecture for the YEAH! application, defining the scope of its core functionalities and translating the methodological, pedagogical, and behavioural ambitions of the project into a coherent digital environment. It provides a shared foundation that guides design decisions while supporting future technical development and integration. It serves as a point of convergence between the needs expressed by the scientific work packages and the practical constraints of real-world use in schools, extracurricular activities, community programmes, healthcare contexts, and households, ensuring that the digital system remains usable, meaningful, and operational across diverse settings.

Within this perspective, the document outlines the structural components required for a fully operational system capable of supporting the intervention and its implementation across different contexts, and of enabling the scientific analyses associated with the project. This includes the measurement and validation work conducted in WP4, the use of data generated during the randomised controlled trial in WP6, their subsequent analysis in WP8, and the implementation of the intervention within case studies carried out in WP7. This includes the integration of the four health behaviours targeted by the study (physical activity, sedentary behaviour, diet, and sleep), the targeted motivational mechanisms defined by WPI, the reporting elements essential for scientific evaluation, and the interfaces intended for children, adolescents, parents and caregivers, teachers, educators and healthcare professionals, and researchers. It also details the functional interdependencies between these components and highlights the importance of ensuring consistency across every stage of data collection, restitution, and interpretation.

This document provides partners with a common and stable functional framework, ensuring a shared understanding of the objectives, constraints, and responsibilities associated with the digital system. It clarifies the application's critical dependencies such as the activity tracker, data flows, questionnaires, intervention protocols, and user roles, and identifies the areas where collective decisions are required to guarantee methodological coherence and operational feasibility. It acts as the reference foundation for design decisions, technical specifications, and the coordination of development and validation phases across the consortium.

Finally, the framework incorporates the essential structural requirements associated with processing sensitive data concerning minors. These include strict pseudonymisation, secure hosting on the SUMMER infrastructure, GDPR compliance, alignment with the project's Data Management Plan, and the application of the FAIR principles to ensure transparency, reliability, and long-term scientific reusability. These requirements shape the architecture

of the system from the outset and ensure that the YEAH! digital tool supports the intervention in a manner that is scientifically robust, ethically sound, and fully compliant with regulatory standards.

In summary, this document establishes the functional foundations of the YEAH! application, guiding its development, ensuring its alignment with scientific and regulatory expectations, and enabling consistency and operational coherence across all work packages involved in the intervention and its evaluation.

## 2. Guiding Principles of the YEAH! Application

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The development of the YEAH! application is guided by a set of foundational principles designed to ensure the scientific coherence of the project, the feasibility of its deployment in school, family and community environments, and strict compliance with European regulatory requirements for sensitive data. These principles articulate the overall functional vision of the system and provide a stable framework that supports development while leaving room for the adjustments and refinements that may emerge through continued collaboration across the work packages.

The first fundamental principle is **ease of use**, considered essential for ensuring adoption by a diverse audience that includes children, adolescents, parents and caregivers, teachers, educators and healthcare professionals. Simplicity here concerns not only the visual interface but the entire user journey, from logging in to accessing information, reviewing data, entering manual declarations and navigating dashboards. The application must enable each user to complete necessary actions in a clear, intuitive and low friction manner, even in time constrained and digitally heterogeneous environments such as classrooms, extracurricular activities or healthcare settings.

The second principle concerns **reliability in data collection and processing**, particularly for the information generated by the Sens.dk activity tracker. This device provides the majority of objective physical activity measurements and may also contribute information related to sleep, depending on its technical capabilities. The application must ensure reliable automatic synchronisation, robust detection of anomalies such as extended absence of transmission or inconsistent entries, and operational continuity through manual declarations when needed. These mechanisms apply to all four health behaviours monitored by the study: physical activity, sedentary behaviour including screen time, diet and sleep. The system will also integrate a motivational indicator defined collaboratively by

WPI and WP4, allowing for pedagogical and behavioural interpretation within the scientific protocol.

The third principle concerns adapted and differentiated data restitution. The application must provide each user profile with information that is relevant, clear and comprehensible. Children must be provided with simple, visual and non-stigmatising information designed to support understanding without inducing comparison. Adolescents may be presented with a slightly higher level of detail, such as basic trends or simple graphical elements, provided these remain accessible and age-appropriate. Parents and caregivers must have access to concise overviews of activity levels and major indicators relating to sedentary behaviour, diet and sleep, along with any elements that may require their attention.

Teachers, educators and healthcare professionals must have access to operational dashboards enabling them to supervise groups, identify particular situations and support the intervention in the field. The exact scope and granularity of the behavioural data accessible to each adult role, particularly for teachers and educators, will require careful consideration in light of data protection requirements, role legitimacy and the principle of proportionality. This issue will be addressed collectively within the consortium to ensure full compliance with GDPR while preserving the operational effectiveness of the intervention.

Researchers, for their part, must access only pseudonymised data exports that comply with FAIR principles and GDPR.

The fourth principle is **reinforced regulatory compliance**, required due to the handling of sensitive data concerning minors and the public health orientation of the project. The application must rigorously adhere to GDPR, the project's Data Management Plan and the FAIR principles (Findable, Accessible, Interoperable, Reusable). No nominative data may be stored within the system. Access rights must be strictly limited according to user role, and export procedures must guarantee systematic pseudonymisation. Requirements relating to traceability, documentation quality, and scientific reproducibility must be supported throughout the digital architecture and the associated workflows.

A final overarching principle is **progressive and controlled evolution**. The application must be capable of integrating refined functionalities, improved representations and additional behavioural dimensions over time, in line with feedback from the field, participant experience, co-creation activities, scientific results and methodological adjustments arising from the work carried out in WP4 and WP6. This approach ensures incremental and purpose

driven development, with each enhancement remaining scientifically justified, operationally feasible and aligned with the expectations and constraints of the consortium.

In summary, these guiding principles form the methodological and functional foundation of the YEAH! application. They ensure that the tool remains usable in real world contexts, aligned with scientific and regulatory expectations, and sufficiently robust to support the intervention as well as its evaluation throughout the duration of the project.

### 3. User Roles

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The YEAH! application is based on a structured organisation of user roles, each corresponding to specific responsibilities, access needs and levels of autonomy. This structure is essential to ensure regulatory compliance, particularly with GDPR, the pedagogical coherence of the intervention, and the effectiveness of interactions between the various stakeholders involved in the project. The definition of these roles directly influences the design of user journeys, permissions, dashboards and data restitution mechanisms, and therefore constitutes one of the foundational pillars of the functional architecture.

In line with the project proposal, the application is primarily conceived as a tool supporting the intervention through adults and peer leaders, notably as a means of training delivery and interaction between behaviour change coaches and adults or peer leaders, and as a means for these actors to monitor and support children's health behaviours. On this basis, the application is expected to rely mainly on an adult-oriented interface. The possible inclusion of an interface dedicated to minors is considered as an option that may be explored collectively if it proves relevant and acceptable from scientific, ethical and regulatory perspectives.

At this stage, and subject to further consortium discussions, the application could rely on two main types of interfaces:

- an interface primarily dedicated to adults, including parents and caregivers, teachers, educators, healthcare professionals and behaviour change coaches, enabling them to support the intervention, access consolidated dashboards, monitor relevant indicators and, where appropriate, complete or correct declarative information

- an interface potentially dedicated to minors, shared by children and adolescents, with content, level of detail, recommendations and interaction modalities adjusted according to age and expected autonomy, should such an interface be retained as part of the intervention design.

If an interface for minors is implemented, its use would remain strictly framed. For children aged 8 to 10, interactions would be highly supervised and limited to simple, positive and non-stigmatising visualisations. They would access only very simplified representations, with other health behaviours such as sedentary behaviour, diet and sleep referenced at most in symbolic form and never through numerical values. Navigation would systematically take place under adult supervision, in line with developmental considerations and regulatory obligations related to digital tools for minors.

Adolescents aged 14 to 16, if granted access to a minors' interface, could benefit from a slightly higher level of autonomy. They might access additional simplified indicators or representations when pedagogically relevant, and could be invited to complete certain manual declarations related to the intervention. Any such autonomy would remain carefully defined, supervised and aligned with ethical expectations, educational objectives and data protection constraints.

Parents and caregivers access information relating to their child or children through the adult interface. Their dashboard provides a clear and synthetic overview of physical activity and other monitored health behaviours, along with notifications requiring their attention when relevant. Their use of the application remains simple and non-demanding. They do not perform operational follow-up but play a key role in understanding the intervention and reinforcing continuity within the family context.

Teachers, educators, healthcare professionals and behaviour change coaches constitute the core operational users of the system. They may access consolidated views of monitored health behaviours at group or individual level, supervise cohorts, identify particular situations requiring attention, monitor activity tracker synchronisation and complete or correct declarative data when necessary. In line with data protection considerations, the exact scope of access to children's behavioural data for each of these profiles will require collective reflection within the consortium to ensure that access rights remain legitimate, proportionate and compliant with GDPR. These users may also perform limited profile adjustments under their responsibility, such as correcting obvious errors in contact information, strictly limited to non-sensitive data and without affecting pseudonymised identifiers.

Researchers hold a primarily analytical and supervisory role. In accordance with GDPR and FAIR principles, they do not access the application through a standard operational interface and do not consult individual dashboards. Their work relies on pseudonymised data exports or, where authorised by the consortium, secure access to the pseudonymised database. In addition, either researchers or a designated member of the research team may need to monitor the quality and continuity of data collection in order to identify technical issues, such as problems with the activity tracker, and trigger appropriate follow-up actions. Researchers may also be involved in assessing the quality of intervention delivery, including indicators such as the number and duration of training sessions between behaviour change coaches and adults or peer leaders, as well as participants' engagement with the application. Depending on final organisational choices, part of this monitoring role could also be assumed by behaviour change coaches.

Finally, a system administrator role, restricted to a small number of designated project members, enables interventions in exceptional cases such as correcting profile associations, merging duplicates, resolving critical errors or adjusting parameters required to maintain system continuity. This role remains invisible to end users and ensures the stability and resilience of the digital infrastructure. The application must include a secure mechanism allowing adult users to request assistance from a system administrator when an issue cannot be resolved independently. The exact form of this mechanism will be defined during development to ensure operational feasibility and full compliance with GDPR and the project's Data Management Plan.

By defining these roles clearly while leaving room for collective arbitration where required, the YEAH! application can address field needs, protect sensitive data concerning minors and remain aligned with the scientific objectives of the project. This role-based organisation provides a flexible yet robust foundation for the system's functional architecture.

## 4. Authentication and Access Management

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Authentication and access management constitute a central component of the functional architecture of the YEAH! digital system. They determine not only the security and regulatory compliance of the platform but also the fluidity of its use in educational, family and research environments. The system must therefore rely on authentication mechanisms that are simple, robust and appropriate for the different user roles described previously.

The authentication framework must meet two inseparable imperatives. The first concerns the protection of sensitive data, particularly data relating to minors and their health behaviors, which fall under a strengthened GDPR regime. Access to the tool must be strictly limited to authorised individuals, with permissions assigned according to clearly defined user roles and restricted to what is necessary for their responsibilities. The second imperative is operational simplicity, essential to ensure adoption of the tool by teachers, educators, healthcare professionals and families, especially in contexts where available time is limited and levels of digital literacy vary widely.

For adults, including parents and caregivers, teachers, educators, healthcare professionals and researchers, access to the application is based on a secure individual authentication method. While an email and password scheme is one possible approach, the application design does not mandate a specific mechanism at this stage. Any selected method must offer a reliable balance between security, usability and technical feasibility. Parents and caregivers access only pseudonymised information relating to their child or children. Teachers, educators and healthcare professionals access the groups for which they are responsible, and researchers access only pseudonymised datasets prepared for scientific analysis, without interacting with operational interfaces.

Authentication for minors follows specific constraints. Children must not be provided with nominative identifiers nor exposed to procedures that are overly technical or intrusive. Their use of the tool must always occur under adult supervision, whether in class, during an educational session or at home. Several access options may be considered for minor profiles, such as supervised access through an adult account, simplified group identifiers, non-nominative usernames or a limited semi-autonomous mode for adolescents. The choice between these options will be defined collectively by the consortium to ensure both practicality and regulatory compliance while guaranteeing that minors do not manage sensitive information themselves.

Relationships between profiles, such as parent and child or teacher and group, are defined in advance through a structured user dataset provided by the intervention protocol. The application is not intended to handle spontaneous sign ups or user generated associations. This approach preserves data integrity, prevents structural inconsistencies and reduces the risk of assignment errors. The system may nevertheless allow teachers and educators to perform a small number of corrective actions, such as fixing an obvious mis-assignment, under strict conditions and within the limits of their permissions.

A system administrator role, restricted to a very small number of authorised project members, is indispensable for the operational maintenance of the platform. This role intervenes only in exceptional situations, such as correcting profile associations, merging duplicates, resolving critical errors or adjusting parameters needed to maintain continuity of the intervention. Administrators do not participate in day to day use of the tool and must operate in full compliance with GDPR and the project's Data Management Plan. The application must also include a secure and appropriate mechanism through which adult users can request assistance from a system administrator when necessary, with the exact form of this mechanism to be defined during development.

In summary, authentication and access management form a fundamental pillar of the YEAH! application. They must combine security, simplicity and robustness, adapting to the needs of the target users and the constraints of the field while ensuring strict compliance with regulatory obligations and the scientific objectives of the project.

## 5. Provisioning and Onboarding

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Provisioning and onboarding constitute a foundational stage in the deployment of the YEAH! application. They determine how user accounts are created, linked and initialised even before data collection begins. This setup phase is particularly important, as it directly conditions the reliability of the entire system, from data integrity to the ease of use experienced by teachers, educators and healthcare professionals, parents and caregivers, and young participants. It requires careful anticipation, close coordination between the relevant work packages, and attention to the practical constraints of school and educational environments.

Provisioning is based on a structured input document, referred to in this specification as the Participant Reference File (PRF). This file serves as the foundation for identifying all participants and their relationships. It describes the children and adolescents involved, the parents and caregivers to whom they are linked, the teachers, educators or healthcare professionals responsible for their supervision, the institutions that host the intervention, and the groups or classes to which each participant is assigned. As the exact structure and fields of the PRF are still being finalised by the consortium, the application must be designed with sufficient flexibility to support variable formats and adapt to the definitive template once agreed.

Based on the PRF, the platform must be able to automatically generate all necessary accounts for minors and adults alike. This mechanism must also establish the permissions

associated with each user role and ensure that all data collected during the intervention are correctly attributed to the appropriate individuals or groups. Provisioning must additionally account for complex real-world situations such as blended families, several supervisors sharing responsibility for the same group, or children participating in multiple educational structures. While not all such configurations must be supported immediately, the overall architecture must remain capable of handling them reliably and at scale.

Onboarding for adults builds directly on the provisioning process. It must remain simple, progressive and fully aligned with security standards. Adult accounts are activated based on information extracted from the Participant Reference File. Users then authenticate through the selected mechanism and confirm the associations preconfigured by the platform. The experience must be intuitive and achievable without technical assistance, while complying with GDPR requirements. Additional safeguards should support consistency, verification of assignments and basic traceability of account activation steps.

Onboarding for minors requires particular caution. Children and adolescents must not manage sensitive identifiers themselves. Their access takes place exclusively through the interface designed for minors and always within a supervised context, whether a classroom, an activity session or a family environment. From their perspective, onboarding consists solely of being presented with a pre-created profile validated by the responsible adult. No direct account management is expected from minors. The degree of autonomy granted to adolescents, particularly with regard to certain declarative interactions, may be refined in collaboration with teachers, educators and scientific partners.

A key process within onboarding is the association between each child and their physical activity tracker. This association occurs during the first synchronisation of the device from the minor's profile. As soon as a tracker synchronises data with the application while linked to a specific child, its pseudonymised identifier is permanently assigned. This approach simplifies operational deployment, reduces technical handling and avoids the need for dedicated pairing procedures in school environments. The technical modalities of synchronisation, whether based on short-range communication, scanning or another mechanism, will be refined during implementation to ensure reliability, clarity and ease of use.

In summary, provisioning and onboarding constitute the entry point to the YEAH! system. They ensure that every profile is correctly initialised, that responsibilities and permissions are clearly established and that data collected throughout the intervention can be interpreted reliably and in full compliance with regulatory requirements. A robust

provisioning and onboarding process is therefore essential to guarantee operational feasibility, scientific integrity and the long-term sustainability of the digital system.

## 6. Activities and Recommendations

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The management of activities and recommendations constitutes a key pillar of the YEAH! application, as it directly connects collected data to the pedagogical, motivational and experiential dimensions of the project. While the monitoring component describes how data are measured, recorded and consolidated, this section focuses on how these data may be used to support day-to-day educational practices involving children and adolescents. It encompasses individual activities, collective activities delivered in real-life settings, adult-initiated proposals for engagement in health behaviours, and simple recommendation mechanisms designed to encourage participation and support the progressive autonomy of young users.

Within the application, an activity refers to a moment or identifiable set of health behaviours relevant to the intervention. Activities may be detected automatically by the activity tracker or entered manually by a teacher, educator or healthcare professional, a parent or caregiver, or, where appropriate, by an adolescent. Activities may originate from structured educational contexts such as workshops, physical education sessions, active play or guided activities delivered face to face by adult supervisors, or from other daily-life contexts (e.g., home, travel). The system must be able to represent this diversity without complicating the user experience, offering an interface that remains simple while sufficiently flexible to reflect real-world situations.

A fundamental distinction exists between individual and collective activities.

- Individual activities correspond to the health behaviours of a single child or adolescent at a specific moment. They are primarily detected through the activity tracker but may also be recorded manually for some health behaviours (e.g., nutrition, screen time), when synchronisation has not occurred or when contextual information is required to ensure continuity of monitoring.
- Collective activities refer to situations in which several children or adolescents participate simultaneously in the same structured activity, typically delivered in person by teachers, educators, healthcare professionals or peer leaders in school or extracurricular settings. These activities are central to the intervention, as group-based physical involvement

constitutes a substantial part of daily practice. If considered relevant by the consortium, the application could allow adult supervisors to declare such collective activities by selecting a group or subgroup of participants, with the objective of documenting activities that take place outside the application itself. The relevance, scope and modalities of this functionality will require collective discussion.

The modalities for describing a collective activity, including the expected level of temporal precision, would need to be defined in collaboration with the scientific teams. Depending on analytical needs, this may range from a simple date to a defined time interval or a more detailed temporal structure. Any such implementation must balance the requirements of scientific robustness with the practical constraints of educational settings, ensuring that data entry remains reliable and manageable for adult supervisors.

In addition to recording activities, the application may provide adult supervisors with the capacity to highlight or propose activities to children and adolescents. These proposals must originate exclusively from teachers, educators, healthcare professionals or coaches and may include suggestions such as participating in a class activity, engaging in a movement break or joining a guided game. These proposals may be displayed within the interface, but they must always be based on explicit adult input rather than automated system logic. The design of this component must remain transparent, understandable and fully controllable by adults.

The recommendation component must not introduce algorithmic personalisation or automated decision-making. Any recommendations displayed to minors must be explicitly authored by adult supervisors and may draw upon the monitored health behaviours, including physical activity, sedentary behaviour, diet, sleep and the motivational indicator defined by the relevant work packages. As the project evolves, these recommendations may be refined, provided they remain aligned with pedagogical objectives, ethical standards and the requirement to avoid stigmatisation, pressure or value judgements.

Finally, the activity framework plays a structural role within the project. It supports motivational processes, contributes to data restitution and facilitates educational interactions between teachers, educators, healthcare professionals and young participants. It must reflect the diversity of school and extracurricular environments, accommodate varied user practices and uphold the overarching requirement to provide a non-stigmatising, accessible and age-appropriate experience for all minors. The consolidated application will integrate these elements into a stable and coherent system informed by scientific guidance and field experience.

Gamification may constitute a complementary component of the YEAH! system, intended to support engagement while fully respecting the educational, scientific and ethical principles of the project. Its role would be to encourage motivation and regular participation without introducing competitive mechanisms, peer comparison or any dynamics that could be perceived as stigmatising.

In line with the intervention design described in the proposal, the application is primarily conceived as a tool for adults and peer leaders. In this context, gamification elements would mainly aim to support their engagement with the intervention, particularly in relation to training delivery, supervision and follow-up activities coordinated with behaviour change coaches. Such elements could help reinforce engagement in the implementation and monitoring of activities targeting children and adolescents, without directly addressing minors themselves.

At the same time, and depending on collective decisions taken within the consortium, notably based on results from WP1 (knowledge base) and WP2 (co-creation), it may be considered relevant to extend access to certain parts of the application to children and adolescents. If this option were retained, gamification elements could be made available to minors under strict conditions. These would include systematic adult supervision, the use of simple and non-comparative forms of positive reinforcement, and full alignment with pedagogical objectives and ethical requirements. Possible elements could include basic visual indicators of participation, encouraging feedback linked to predefined milestones, or symbolic acknowledgements of regular engagement. In all cases, these elements would remain discreet, accessible and clearly non-evaluative, and would not interfere with the scientific interpretation of collected data.

The precise definition of gamification mechanisms, including their target users, scope and modalities, will be developed jointly with the scientific teams and the relevant work packages. This notably includes WP1 for the identification of appropriate psychological mechanisms to target and related behaviour change techniques, WP4 for insights derived from field implementation, and the WP2 co-creation teams to ensure alignment with the needs and constraints of adults, peer leaders and, where applicable, children and adolescents.

Overall, gamification is not intended to constitute a central component of the YEAH! system. Rather, it represents a potential and adjustable lever to support engagement, whose relevance and implementation will be refined progressively based on field observations,

scientific recommendations and collective decisions of the consortium, in full coherence with the overarching principles of the project.

## 7. Activity Monitoring

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Activity monitoring represents the central function of the YEAH! application, both for supporting children and adolescents and for ensuring the scientific robustness of the intervention. The entire protocol relies on the system's capacity to collect, organise and reconstitute reliable, continuous and scientifically interpretable data. This collection draws on two complementary sources: objective measurements transmitted by the Sens.dk activity tracker, and manual declarations made by teachers, educators and healthcare professionals, parents and caregivers, or adolescents when the device cannot provide complete information. The challenge is therefore not only to capture physical activity and other health behaviours, but also to maintain continuity, completeness and coherence of monitoring across the diverse situations encountered throughout the intervention.

### 7.1 Automatic collection via the activity tracker

The Sens.dk activity tracker constitutes the main source of objective measurement of physical activity and sleep within the YEAH! system. It records movement-related information including intensity, duration and frequency, and stores these data until they are synchronised with the application. Regular synchronisation is essential to ensure high-quality monitoring. A daily synchronisation rhythm has been adopted because it aligns with the educational and declarative logic of the intervention, establishing a routine that is coherent, easy to understand and naturally integrated into school and family environments. This frequency may be adjusted in the future based on insights from field implementation and decisions taken collectively within the consortium.

In practice, synchronisation must be simple, direct and accessible to teachers, educators and healthcare professionals. The system must clearly indicate whether the latest synchronisation is recent, incomplete or missing, and must alert users when data have not been received for a significant period. This visibility is essential to ensure that each child benefits from consistent monitoring and to enable rapid identification of interruptions. When synchronisation cannot occur, whether due to a forgotten tracker, low battery, technical malfunction or incorrect placement of the device, the application must allow adults or authorised adolescents to complete the day with a manual declaration so that continuity of monitoring is preserved.

In addition to routine use, the system must safeguard the overall integrity of automatic collection. This includes reliable detection of the tracker, accurate transmission of data, preservation of temporal information and appropriate handling of periods without synchronised data. As the application evolves, mechanisms for longitudinal monitoring and quality assurance will be strengthened to support scientific analyses and ensure that collected data remain coherent, complete and interpretable across the full duration of the intervention.

## 7.2 Manual declarations: activities and other behaviours

Manual declaration plays an essential role in maintaining the balance of data collection. It ensures continuity of monitoring when the activity tracker cannot provide information and allows the system to incorporate situations whose collective nature or specific conditions make automated individual detection difficult.

In school or extracurricular contexts, many activities take place in groups, including physical education sessions, guided workshops, collective games and supervised sports activities. These configurations are not always interpreted uniformly by the activity tracker, and it would be neither realistic nor desirable to require each child to synchronise their device individually during a shared session. The application must therefore allow a teacher, educator or healthcare professional to declare a collective activity efficiently by selecting a group or subgroup of children in a single action.

The required level of precision for these collective activities, whether a simple date, a defined time interval or a more detailed temporal description, will be determined in coordination with the scientific teams. The goal is to ensure that the application supports formats needed for rigorous analysis while maintaining usability for teachers, educators and healthcare professionals who operate within time-constrained environments.

Manual declaration also covers other health behaviours that complement physical activity. These include sleep, diet, sedentary behaviour including screen time, and motivational indicators. As fully declarative elements, these dimensions are essential for personalised support and for maintaining a comprehensive understanding of the behaviours monitored by the intervention. Their format, including scales, frequency and restitution, will be defined by the scientific work packages and refined in collaboration with the pedagogical teams to ensure clarity and feasibility.

Data entry is performed by an adult, such as a parent or caregiver, teacher, educator or healthcare professional, or, when appropriate and explicitly authorised within the protocol, by adolescents themselves. Children aged 8 to 10 are never required to enter these data directly, in line with developmental considerations and regulatory requirements governing digital use by minors.

By integrating collective activities, undetected activities and declarative health behaviours, manual declaration ensures that monitoring remains coherent, complete and scientifically usable across the full duration of the intervention.

### **7.3 Continuity, resilience and data quality**

The scientific quality of collected data depends on the system's ability to maintain coherent continuity despite everyday contingencies and logistical constraints. The application must therefore be able to identify periods without data in a timely manner, support appropriate follow-up actions, document legitimate reasons for interruptions such as injury, exemption or prolonged absence, and ensure a minimum level of traceability for synchronisation events. These mechanisms are essential to preserve the integrity of the dataset and to support accurate interpretation by the scientific teams.

Within this process, several actors may play a complementary role depending on the organisation of the intervention. Teachers, educators and healthcare professionals may be involved in monitoring data collection in field settings and in identifying situations requiring action. In addition, the behaviour change coach and one or more designated members of the research team may be responsible for overseeing data continuity at a broader level, identifying recurring issues in data collection and coordinating follow-up when technical or organisational problems arise.

These actors must have access to a clear and timely overview of relevant indicators, such as the most recent data received, declared collective activities, documented interruptions and potential anomalies. This visibility supports informed decision-making, facilitates appropriate corrective actions and helps ensure that data transmitted for scientific analysis remain coherent, complete and reliable.

To support long-term data quality, the system must incorporate appropriate safeguards and consistency checks, both to limit gaps in data collection and to ensure that interruptions are correctly documented. The definition of responsibilities and workflows related to data quality monitoring will be refined collectively within the consortium. As the

application evolves, mechanisms for longitudinal review, integrity validation and overall quality control will be strengthened to meet the analytical requirements of the intervention and to guarantee that the dataset remains robust and interpretable at cohort scale.

## 8. Dashboards

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Dashboards constitute the central interface through which users access the essential information of the system. They play a structuring role in supporting understanding, engagement and guidance for children and adolescents, while providing adults responsible for supervision with a clear and coherent set of indicators to monitor the progression of the intervention. Their design must respond to a dual imperative: offering an accessible, reassuring experience for young users, and providing parents and caregivers, teachers, educators and healthcare professionals with the visibility required to ensure continuity and quality of monitoring. Dashboards are not simple graphical displays; they function as a mediation interface between collected data, educational practices and the scientific requirements of the project.

### 8.1 General principles and overarching philosophy

All dashboards rely on principles of clarity, simplicity and accessibility. Information must be immediately understandable without requiring technical expertise, in contexts where children use the tool under supervision and where teachers, educators and healthcare professionals have limited time to navigate. Indicators must be presented in a non-stigmatising manner, favouring visual representations, simple symbols and neutral messages. Dashboards must never encourage competition between children or promote comparisons between peers. Navigation must remain intuitive and coherent across user profiles and follow best practices for accessibility, particularly for young and heterogeneous audiences.

Dashboards will progressively integrate the different dimensions of the intervention, including activity tracking, declarative elements and educational content when relevant. Their design will evolve in collaboration with scientific and pedagogical teams to ensure readability, usability and alignment with the intervention protocol.

## 8.2 Dashboard by User Role

### Children

Depending on collective decisions within the consortium, the children's dashboard prioritises a simple, visual and reassuring approach. It highlights elements that are immediately understandable, such as recent activity, symbolic gauges, light indicators of progress or consistency and encouraging messages. Limited gamification elements may be incorporated, provided that they remain age-appropriate, non-comparative and focused on valuing effort. The interface may also present very simple recommendations or educational content, such as brief messages, illustrations or short videos, produced by teachers, educators, healthcare professionals or behaviour change coaches. The objective is to guide without judgement, support intuitive understanding of physical activity and ensure that use of the application always takes place under adult supervision.

### Adolescents

Depending on collective decisions within the consortium, the adolescents' dashboard follows the same foundational principles as the children's interface. Where pedagogically justified and operationally feasible, it may allow the integration of additional elements such as simplified graphs, basic temporal trends or synthetic indicators related to broader health behaviours. Age-appropriate educational content or recommendations produced by teachers, educators, healthcare professionals or behaviour change coaches may also be included. Any evolution of this interface must remain aligned with the overarching principles of readability, emotional safety and non-stigmatisation, and should be introduced only following validation by pedagogical and scientific teams.

### Parents and caregivers

The dashboard for parents and caregivers provides a synthetic overview of their child's monitored behaviours, including activity levels, available or missing information, general trends and notifications that may require their attention. It may also relay educational messages or recommendations developed within the project to support continuity of guidance in the home environment. Depending on implementation choices, this interface could also include interaction tools, such as a discussion space or private messaging features, enabling parents and caregivers to exchange with behaviour change coaches or other adults involved in the intervention. The purpose of this dashboard is not to promote

behavioural assessment, but to facilitate understanding of the intervention and support overall engagement.

### **Teachers, educators, healthcare professionals, and behaviour change coaches**

The dashboard for teachers, educators, healthcare professionals and behaviour coaches is the most comprehensive among operational profiles. It must provide a rapid overview of the group under their responsibility, including recent or missing synchronisations, declared individual or collective activities, situations requiring attention, and the need to complete or correct certain data. A simplified individual view must also enable professionals to examine each child's situation, identify data interruptions and perform necessary adjustments. This interface also serves as a central space for intervention delivery and coordination. It includes dedicated modules allowing behaviour change coaches to deliver training sessions remotely through videoconferencing tools, to support experience sharing between adults via a discussion forum, and to enable private interactions between adults and behaviour change coaches through a secure chat functionality. In addition, the dashboard supports the dissemination of recommendations, educational materials and guidance produced by behaviour change coaches and, where relevant, by members of the research team. Together, these elements are designed to support structured intervention delivery while remaining fully consistent with regulatory, ethical and data-protection constraints.

### **Researchers**

Researchers access data primarily through pseudonymised exports, ensuring compliance with GDPR and FAIR principles. In addition, it may be considered relevant for one or more designated members of the research team, or for behaviour change coaches acting in coordination with researchers, to have access to dedicated monitoring views. Such views could allow supervision of data collection quality, identification of issues related to sensor functioning, assessment of intervention delivery (for example, number and duration of training sessions between coaches and adults or peer leaders), and analysis of participant engagement with the application. The scope and modalities of this access will require collective discussion within the consortium to ensure full alignment with scientific objectives, data protection requirements and governance rules.

## 9. Reporting and Exports

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Reporting and data exports constitute an essential component of the YEAH! application, as they ensure continuity between field data collection, educational support and the scientific evaluation carried out within the analytical work packages. The system must allow each user role to access only the information relevant to their responsibilities while guaranteeing full regulatory compliance for sensitive data, particularly those relating to minors. This requirement implies rigorous data structuring, user-appropriate restitution and controlled delivery of exports for research purposes.

Within the application, data restitution takes the form of dashboards tailored to each user role, combining objective measurements from the activity tracker with declarative elements recorded during the intervention. Reporting for children and adolescents must remain simple and visual, encouraging intuitive understanding of their activity without introducing judgement or comparison. Reporting for parents and caregivers, and for teachers, educators and healthcare professionals, must present a structured overview of observed behaviours, the presence or absence of recent data and any actions required to maintain continuity of follow-up. This information must be readable, accessible and fully aligned with the project's overarching objective of providing an educational, non-stigmatising and participant-centred experience.

Access to data for researchers follows a different logic. Scientific teams do not interact with visual dashboards intended for participant-facing follow-up; instead, they primarily rely on data exports specifically designed for the analyses required in the research work packages. These exports must be strictly pseudonymised, coherently structured and provided in open formats such as CSV or JSON, in accordance with FAIR principles and the open-science commitments set by Horizon Europe. No nominative data are ever made available, and exports must contain only pseudonymised identifiers whose correspondence with real profiles is maintained outside the application in accordance with GDPR requirements. Depending on collective decisions within the consortium, it may also be envisaged that designated members of the research team, and/or behaviour change coaches acting in coordination with researchers, could access specific monitoring views or indicators. These would be limited to supervising the quality of data collection, identifying potential issues in sensor functioning, assessing the quality of intervention delivery and monitoring participant engagement, without constituting participant-facing dashboards.

The application must also be capable of integrating into its reporting all health behaviours documented in the project, including physical activity, sedentary behaviour, diet, sleep and, when defined by the consortium, the motivational indicator. The structure, aggregation and form of restitution for these data will depend on scientific needs and field feedback. The goal is to ensure that reporting remains both scientifically interpretable and operationally useful for all categories of users, while respecting ethical, regulatory and methodological constraints.

Data exports must be robust enough to interface with the statistical methods used in protocol analysis while remaining straightforward for scientific teams to process. They must be producible at regular intervals and on demand, in a stable and well-documented format that includes all necessary interpretation elements such as file structure, variable descriptions, units and calculation rules where applicable. This documentation is essential to ensure transparency, reproducibility and reusability of the data within WP6 and for dissemination deliverables.

Finally, beyond internal reporting, the YEAH! project adheres to an open-data policy for non-sensitive elements. Datasets stripped of personal information and suitable for public dissemination may be made available through open repositories in accordance with the Data Management Plan. The application must therefore support a clear and well-organised data structure to facilitate the preparation of open-source deliverables and the publication of anonymised datasets on platforms required by Horizon Europe.

## 10. Notifications

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Notifications play an essential role in ensuring the continuity and reliability of the YEAH! system. They serve as an information mechanism designed to support adults responsible for monitoring whenever certain situations require their attention in order to preserve consistency in follow-up. Notifications are not intended to structure daily use of the application or to place unnecessary demands on participants. Their purpose is strictly operational and limited to situations where human intervention is necessary to guarantee the quality of collected data or the correct execution of the intervention protocol.

The functioning of the activity tracker and the need for regular synchronisation imply that certain interruptions must be signalled. A notification may therefore appear within the application when no data have been received for a significant period or when an anomaly prevents transmission. Such cases may include an undetected tracker, an incorrectly

positioned device, an incomplete synchronisation or a simple oversight compromising data continuity. In these situations, the notification must allow the parent, or the teacher, educator or healthcare professional and, where relevant depending on the monitoring organisation adopted within the consortium, the behaviour change coach or designated members of the research team, to understand the issue and act easily to resolve it, whether by repositioning the device, reminding the child to wear it or completing the information manually when necessary.

Notifications also form part of the declarative logic. When certain data cannot be collected automatically, adults or authorised adolescents must be able to enter them manually. Notifications therefore act as occasional, non-intrusive reminders prompting the user to complete the day, clarify a specific context or indicate a circumstance that prevented automatic collection. They must remain neutral, supportive and fully free of judgement or pressure.

Notifications are delivered exclusively within the application. No email or external communication channel is used, in order to limit demands on families and maintain a controlled, predictable and respectful user environment. Their frequency, activation thresholds and scope will be defined jointly with technical and scientific teams, taking into account the specificities of school settings, family routines and the project's commitment to avoiding unnecessary informational load.

Finally, notifications must fully comply with regulatory requirements. They must not communicate sensitive data, disclose nominative information or exceed the permissions defined during provisioning. They constitute a discreet and supportive mechanism designed to assist families, teachers, educators and healthcare professionals while ensuring that monitoring remains reliable, continuous and scientifically interpretable throughout the intervention.

## 11. Major Constraints

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The development of the YEAH! application takes place within a particularly constrained framework from regulatory, technical and operational perspectives. These constraints are not merely compliance markers; they determine how the tool must be designed, used and evaluated. They form the backbone of the system and ensure that the application can meet the requirements of the scientific protocol while respecting the legal obligations associated with handling sensitive data concerning minors.

## 11.1 Regulatory constraints and data protection

The application processes data relating to children and their physical activity, placing the entire system under a strengthened GDPR regime. As such, no nominative data may be stored within the application or its hosting environments. Child profiles must be handled exclusively through pseudonymised identifiers, and any nominative correspondence must be managed outside the tool in accordance with the processes defined in the intervention protocol.

Explicit parental consent is a prerequisite for participation. Similarly, restitution and notification mechanisms must strictly follow the roles and associations established during initial provisioning. No user may access information outside their authorised scope, and no sensitive information may be communicated through notifications or via unsecured channels.

The entire system must follow the recommendations of the project's Data Protection Officer and apply the best practices described in the Data Management Plan. Compliance with the principles of minimisation, access traceability and least privilege constitutes a core requirement of the functional architecture.

## 11.2 Hostings, security and the Open Science Framework

Sensitive data must be hosted on the SUMMER infrastructure, located in France and compliant with the required standards for hosting health-related data. This requirement ensures data protection, controlled retention for the period mandated by regulation, and availability for scientific work associated with the intervention and the clinical protocol.

All exchanges between system components (application, server, synchronisation devices) must be encrypted, and any temporary local storage, particularly in offline scenarios, must also be systematically encrypted. More broadly, the architecture must ensure end-to-end security while remaining fully compatible with use on tablets or computers in school environments.

Alongside these regulatory requirements, the project adheres to an open-data approach for non-sensitive elements. The source code must be versioned and deposited on open platforms associated with Horizon Europe, and publicly released datasets must be anonymised, documented and compliant with the FAIR principles (Findable, Accessible,

Interoperable, Reusable). These expectations require rigorous and forward-looking data structuring from the earliest stages of design.

### 11.3 Material, field and timeline constraints

The system's proper functioning depends heavily on the reliability of the activity tracker supplied by the external partner Sens.dk. The exact characteristics of the dataset, including sampling frequency, types of measurements, internal storage capacity and maximum interval between synchronisations, must be confirmed upon receipt of the full technical documentation. The tracker's ability to operate effectively in school, extracurricular and family environments is a critical determinant of the protocol's success.

School environments introduce specific constraints, including the widespread prohibition of native smartphone applications, the requirement for a fully web-based interface, the need for simple interactions and the limited availability of adult supervision during class hours. The interface must therefore be designed to accommodate these constraints while maintaining high accessibility for young users.

The project timeline also imposes strict constraints. The application must be designed, developed, tested and stabilised within a schedule aligned with the scientific protocol and the operational needs of the intervention. The system must therefore be robust, maintainable and capable of supporting large-scale deployment within the timeframe required for the WP6 randomised controlled trial.

Taken together, these temporal, material, regulatory and methodological constraints must guide all design and development choices from the outset to ensure project coherence, field feasibility and the scientific quality of the intervention.

## 12. Pending Decisions and Working Assumptions

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The development of the YEAH! application takes place in a context where several structuring elements of the system must still be collectively defined within the consortium. Some aspects relate to ongoing scientific and methodological work, including the expected temporal granularity for collective activities, the exact modalities of declarative entries for nutrition, sleep and sedentary behaviour, the operational definition of the motivational indicator and the final positioning of educational recommendations within the user journey. In parallel, the definitive structure of the Participant Reference File and the complete

technical documentation of the Sens.dk activity tracker constitute essential prerequisites for fully stabilising the functional architecture.

To ensure that development can progress while these elements are being finalised, a set of working assumptions has been defined. These assumptions provide a coherent basis for initial implementation, while preserving the consortium's ability to refine scientific and pedagogical choices as new insights emerge. They include, for example, simplified formats for declarative entries, a restitution model centred on recent activity and a limited number of synthetic indicators, and a daily synchronisation rhythm aligned with the entry of health behaviours. These assumptions will be progressively refined as scientific requirements become clearer and as feedback from field implementation is collected.

Several modalities are intentionally left open at this stage, particularly those relating to the form and frequency of pedagogical content delivered to minors, such as guidance messages, educational materials or videos, the degree of autonomy that may be granted to adolescents and the formats best suited for manual declarations. These elements will evolve through field observations, co-design activities and exchanges with pedagogical, educational and scientific teams.

The consolidation of these decisions will represent a key milestone in achieving the stabilised version of the YEAH! application required for the WP6 randomised controlled trial and WP7 case studies. This iterative clarification process will ensure a coherent and methodologically sound development pathway, fully aligned with regulatory, scientific and operational requirements, and will guarantee that the final tool is grounded in choices validated collectively by the consortium.